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Effects of spaced retrieval on memory and quality of life in older adults with probable Alzheimer's disease

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EFFECTS OF SPACED RETRIEVAL ON MEMORY AND QUALITY OF LIFE IN OLDER ADULTS WITH PROBABLE ALZHEIMER'S DISEASE

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ABSTRACT

This study was designed to explore the effects of spaced-retrieval training on memory and quality of life in older adults with probable Alzheimer's disease. A total nineteen older adults with probable Alzheimer's disease (AD) participated in these experiments. Experiment one was designed to determine whether the spacing effect is contributing to the success of the spaced-retrieval intervention. Participants were trained to recall a name-face association using either the adjusted spaced-retrieval method or a fixed interval retrieval method. The results showed a more consistent performance profile for the spaced retrieval group in comparison to the fixed interval group, providing evidence that the spacing effect is contributing to the gains in memory associated with spaced retrieval. Experiment two explored the effect of supplemental training sessions, 'booster sessions', on long term retention of the name-face association at a six month retest after the initial spaced retrieval training. The findings show booster sessions enhanced the long term effectiveness of the intervention, particularly during the first retest session. Experiment three examined the flexibility of the spaced retrieval method for use with familiar name-face associations. Subjects were trained on a familiar name-face association using the same methodology previously used for a non-familiar name-face association. Results indicated that the intervention could be useful in training familiar name-face associations. In addition to these specific experiments, quality of life was measured for all participants in each experiment prior to and after receiving the spaced retrieval intervention. Results provide preliminary evidence of a link between performance on the spaced retrieval task and improved rankings of quality of life.

INTRODUCTION

Older adults comprise one of the fastest growing segments of the population in the United States. The 2000 Census reported that those older adults, those Americans age 65 and over, total 35 million people or 12.4 percent of the total U.S. population. This number is up 3.8 million from the census conducted in 1990 (U.S. Bureau of the Census, 2004). Even though this age group increased by close to 4 million, the 2000 census indicates that this is the first decade that older adults did not represent the fastest growing age group. This trend is believed to only be temporary, resulting from the large number of baby boomers that began reaching the age of 45 in this decade. The age group that includes the baby boomers, age group 45-54, grew 49 percent in this decade and currently represents the fastest growing section of the population.

As the baby boomers begin to reach age 65, beginning in 2011, the elderly population is expected to substantially increase and the trend of persons over age 65 being the fastest growing segment of society is expected to reemerge. The number of older adults in America is expected to reach 18 percent by 2025. During the 1990's, the oldest-old population, those over 85 years of age, grew by 38 percent. This group currently includes 4.2 million Americans. These demographic trends are of great concern to social planners and other professionals in senior service fields. One pressing concern is that the largest growing segment of older adults, those 85 and over, is also the age group with the highest risk of Alzheimer's disease (AD). As many as half of all persons over the age of 85 are believed to be suffering from AD (Evans, Funkenstein, & Albert, 1989).

As the number of persons with adult dementia increases, the number of persons caring for these individuals will also increase. There are currently over 22 million households in

the U.S. providing care for older adults. Dementia related disease exists in more than 20% of these cases (Ory, Hoffman, Yee, Tennstedt, & Schulz, 1999). That calculates to more than 5 million U.S. households caring for a dementia patient. A National Institute on Aging (NIA) (1999) Alzheimer's disease report estimated the cost of caring for an AD patient in terms of mild, moderate and severe dementia. The annual costs associated with the care of a mild dementia patient were $18,408, the moderate dementia patient $30,096 and the severe dementia patient $36,132. The average lifetime cost of caring for an AD patient is estimated to be $174,000 (NIA, 1999). Alzheimer's disease is certain to remain a prominent public health issue as our country continues to age and the number of persons affected by AD increases. As a result, research in the area of interventions for AD is important to improve the quality of life, not only for persons suffering with AD, but those who care for them.

This paper is organized as follows. In the first section, definitions and diagnostic issues in adult dementia are discussed. In the second section, specific background information on Alzheimer's disease is discussed. In the third section, mental and behavioral deficits present in Alzheimer's disease patients are addressed. The fourth section focuses on cognitive deficits associated with Alzheimer's disease, with emphasis on deficits in memory. The fourth section also addresses quality of life and the issues of measuring the concept in persons with AD. Section five explores interventions to improve retention, with a detailed investigation of the spaced retrieval method. In the last section, specific aims of the present research are presented, followed by the research methods and expected outcomes sections.

REVIEW OF LITERATURE

Adult Dementia: Definitions and Diagnostic Issues

Raskind and Peskind (1992) define dementia as a syndrome that includes a group of signs and symptoms that cluster together. Adult dementia can be produced by many different underlying, etiologically distinct physical conditions. In other words, the dementia syndrome can be produced by multiple disorders, such as Alzheimer's disease, Parkinson's disease and Huntington's disease, to name a few. The DSM-IV describes the development of multiple cognitive deficits, which must include memory impairment as the key defining condition in dementia (American Psychiatric Association, 1998). Table 1 outlines the most common disorders and symptoms associated with the dementia syndrome (Raskind & Peskind 1992). Although the symptoms of dementia are easily observed, diagnosis, especially in the early stages, can prove difficult for clinicians. Behavioral problems are typically the presenting symptoms that prompt an evaluation for dementia (Jarvik, 1980). The subjective nature of these types of symptoms can make it difficult to determine exactly what factors are responsible. Dementia is a major feature of Alzheimer's disease, but other conditions that cause dementia must be ruled out first before a provisional diagnosis of AD would be warranted. For example, depression in particular can prove difficult to distinguish from dementia, especially in the early stages (Raskind & Peskind, 1992). In addition, there are multiple dementia syndromes as well as other common reversible and irreversible causes of dementia that should be considered on initial assessment. The reversible conditions that can cause the dementia syndrome include acute confusional states, drug effects, malnutrition, depression, psychological and social stresses, paranoid disorders and

intracranial lesions [for further discussion of these conditions see Jarvik, 1980, and Cherry & Plauche, 1996].

Although there is currently no cure for AD, early detection of the illness is beneficial on many levels. The advantages for the patient and family include getting answers to questions and gaining understanding that the illness is responsible for personality and cognitive changes. Early detection also allows for better planning for the future, including legal provisions for the patient, such as power of attorney and living wills. Early evaluation permits the clinician to create a more specific treatment plan and better predict the course of the illness. Society benefits from early diagnosis of AD through cost savings brought about by the delayed institutionalization of the patient, a decrease in the number of driving accidents and a larger population for AD research (Doraiswamy, Stefferns, Pitchumani, & Tabrizi, 1998).

Background Information on AD

The first physician to recognize what is known today as Alzheimer's disease was Aretaeus of Cappadocia in the 2nd Century AD. Through the centuries, other physicians speculated on the nature of the deterioration of mental faculties in old age in some cases. By the early 1900's, the key neurological features of Alzheimer's disease had been determined. The three key features included: the description of senile plaques by Redlich (1892), neurofibrillary tangles by Alzheimer (1907), and granulovacuolar degeneration by Simchowitz (1910). Kraeplin gave the name Alzheimer's disease in honor of his pupil and key contributor, the German physician, Alois Alzheimer [for further discussion see Cherry & Plauche, 1996, and Reisberg, Ferris, deLeon, Crook, & Hayes, 1987].

Table 1: Common Disorders Associated with Dementia Syndrome

Type	Presenting symptoms
Alzheimer's disease	Insidious onset, progressive deteriorating course. In early stages; subtle difficulties in memory, memory loss more marked for recent events, repetition in conversation, disorientation in unfamiliar settings. Definitive diagnosis only after autopsy.
Multi-infarct dementia	A vascular dementia, abrupt onset, stepwise deterioration, focal neurologic signs and symptoms.
Cruetzfeldt-Jakob disease	Rare, fatal brain disorder. Memory declines, loss of coordination, pronounced mental deterioration, involuntary muscle spasms, blindness, weakness in arms and legs, coma. Definitive diagnosis only after autopsy.
Dementia with Lewy bodies[1]	Widespread Lewy bodies in CNS. Dementia, variation in cognition with extreme fluctuation in alertness, visual hallucinations. Episodes of confusion and depression more frequent than in AD.
Parkinson's disease	Loss of motor ability, memory impairment, slowness of thinking, preserved language ability.
Pick's disease	Rare dementing disorder, clinically similar to AD, although the neurochemistry and neuropathology is quite different from AD. Changes in personality, orientation.
Huntington's disease	Begins in midlife, intellectual decline, irregular and involuntary movement of limbs/facial muscles. Personality change, memory declines, slurred speech, impaired judgment, psychiatric problems. Genetic marker identified on chromosome 4.

Note. Table adapted from Cherry and Plauche, 1996.
[1] Information taken from Lopez et al., 2000.

A central feature of AD is the damage and destruction of neurons in the brain. There are two primary approaches to understanding the specific nature of the damage to neurons. The first is represented by biochemical studies that look at neuritic plaques and

neurofibrillary tangles. The second approach is represented by molecular genetic studies, which look at chromosomes 21, 14, and 1 (Peskind, 1996). These two approaches are discussed more fully next.

Alois Alzheimer described a prominent physical component of AD, the neuritic plaque, in his original description of the disease (Gruetzner, 1992). These plaques are normally found in the brain but are found in significantly higher amounts in the brains of AD patients. Those patients most severely impaired by AD have a higher prevalence of plaques in their brains. Plaques accumulate in the areas of the brain that are most effected by AD, such as the cerebral cortex and more specifically the temporal lobe. The presence of plaques in the brain may be a better predictor of AD than neurofibrillary tangles (Greutzner, 1992). The main component of the neuritic plaque is a protein B–amyloid. Whether the B-amyloid concentration caused neuronal damage or is a consequence of such damage is a central debate among researchers (Peskind, 1996).

Neurofibrillary tangles in the brain have been identified as a symptom of AD since the 1900's when Alois Alzheimer first described the condition. Gruetzner (1992) defines neurofibrillary tangles as "bundles of ordinary brain filaments that have become badly twisted (p. 210)." Filaments when viewed under a microscope appear hair-like. The presence of filaments in the brain is normal. When the filaments change and become twisted, they are considered abnormal. These tangles are found in the areas of the brain that affect memory and behavior. The severity of memory impairment and behavioral disturbances may be directly related to the amount of tangles found in the corresponding area of the brain (Gruetzner, 1992).

Recently there have been great gains in the research surrounding Apolipoprotein (APOE) and the connection to Alzheimer's disease. The gene for APOE is found on chromosome 19. There are three common isoforms; apoE-2, apoE-3, and apoE-4. The isoform apoE-4 has been identified as a genetic indicator for susceptibility for Alzheimer's disease. There is an association between the apoE-4 allele in both familial late-onset and sporadic AD patients (Haines et al., 2001). Age of onset of AD is lower in individuals who have the apoE-4 allele (Flory, Manuck, Ferrell, Ryan & Muldoon, 2000). There is evidence that suggests the apoE-2 allele is underrepresented in those with AD and that perhaps this allele has a protective effect (Liddel, Lovestone & Owen, 2001). Individuals having homozygosity for the apoE-4 allele have five to eight times the risk for developing AD than individuals who do not have the apoE-4 allele. Individuals with heterozygosity for this allele have a risk that is two to three times greater than persons without the allele (Flory et al., 2000). The apoE-4 allele has also been associated with lower cognitive status scores in older adults who are not demented. Dik et al. (2001) found that apoE-4 allele carriers showed a more rapid rate of decline in cognitive functioning (measured by the MMSE) and slower information processing speeds over a 6-year period. In addition, a study by Flory et al. (2000) found middle-aged adults with the apoE-4 allele, in comparison to those with the apoE-2 and 3 genotypes, performed significantly poorer on tests of learning and memory. These findings that apoE-4 is a marker for age-related decline in memory has added to the debate of the role of APOE as a predictive test in identifying those at risk for AD. Liddell et al. (2001) and Reiman et al. (2001) indicate that individuals with the apoE-4 genotype have a greater than 50% chance of never developing AD and therefore there is currently no role

for APOE genotyping as a test for use in predicting AD in those patients who have concerns about developing the disease.

Prevalence of AD

Currently, five percent of the world's population suffers with Alzheimer's disease (Henderson, 1998). There are an estimated 18 million cases of AD worldwide (Henderson, 1998) and 4 million cases in the United States (NIA, 1999). Each year 360,000 new cases will be diagnosed. By 2020 there will be 30 million cases throughout the world (Henderson, 1998). In the U.S., it has been estimated that 14 million Americans will have the diagnosis by the year 2050 (NIA, 1999). The nursing home population is made up of a significant amount of dementia patients. The estimates range from 50% to 80% of all nursing home residents suffer with dementia (Hendrie, 1997). The increasing prevalence of Alzheimer's disease has made the illness an important public health issue.

Alzheimer's disease places a major economic burden on U.S. society. The national annual cost estimates for caring for dementia patients ranges from $60 to 120 billion (Hendrie, 1997). The 1997-2007 projections by the U.S. Health Care Finance Administration show predicted total health care expenditures to increase by 85 percent. Additionally, nursing home health care expenditures are predicted to show a similar increase of over $148 million (Michel et al., 2003). The large number of persons with dementia living in these facilities is likely contributing to this trend.

The average cost of nursing home care ranges from $42,000-$70,000 a year (NIA, 1999). Medicare benefits will pay for the first 90 days in a nursing home. After that initial time period, the patients are then responsible until their financial resources are exhausted. Once personal resources are diminished, Medicaid will pay the full amount of care (Holden,

1987). Close to two-thirds of all Medicare enrollees who had a diagnosis of AD or dementia reside in a long term care facility (Eppig & Poisal, 1996). Managed Medicare total costs per year for patients with dementia were 1.5 times higher than for patients without dementia. Seventy five percent of these higher costs were linked to inpatient expenses (Gutterman, Markowitz, Lewis, & Fillit, 1999).

In addition to the costs to care for AD patients there are also research expenses. The amount the federal government plans to spend on research in the area in 1999 is 400 million dollars (Alzheimer's Association, 1998). This number has drastically increased over the last 25 years when funding in 1976 reached about 4 million dollars (Holden, 1987).

As noted previously, Alzheimer's disease has commonalties with several other disorders. The uniqueness of Alzheimer's disease is best addressed by examining the DSM-IV criteria. Table 2 contains the DSM-IV criteria for dementia of the Alzheimer's type (American Psychiatric Association, 1994). Dementia involves progressive decline in both cognitive abilities and daily functioning, such as activities of daily living, communication, and social activities. In recent years, functional staging systems have been developed to monitor the gradual progression of deterioration (Cohen-Mansfield et al., 1996). The dementia patient can be assessed and placed appropriately along the staging continuum. Staging benefits future research in multiple ways. First, staging the natural course of dementia allows baseline information to be collected and to compare different samples of population and infer appropriate conclusions. Staging also helps the clinician to predict the course of the disease. Finally, utilization of staging systems may also prove useful in development of future societal policies (Reisberg et al., 1987). Table 3 contains the functional assessment stages in normal aging and AD.

Table 2: Diagnostic Criteria for Dementia of the Alzheimer's Type

DSM IV Criteria

A. The development of multiple cognitive deficits, including both:
    1. Memory Impairment
    2. One or more of the following cognitive disturbances:
        a. aphasia - problem speaking and understanding language
        b. apraxia - inability to make purposeful movement
        c. agnosia - inability to recognize an object
        d. disturbance, in executive functioning
B. Cognitive deficits cause significant impairment in social or occupational functioning and represent a significant decline from a previous level of functioning.
C. Gradual onset and continuing cognitive decline
D. Cognitive deficits are not due to any of the following:
    1. other central nervous system conditions
    2. systemic conditions that are known to cause dementia
    3. substance-induced conditions
E. The deficits do not occur exclusively during the course of a delirium
F. The disturbance is not better accounted for by another Axis I disorder

Note. Table adapted from Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994).

Mental and Behavioral Deficits in AD Patients

Mental and behavioral disturbances are a central feature in dementia. Most all patients will exhibit these types of behavior at some point in their illness, which are often the most challenging symptoms to address**.** The Cache County, Utah study on memory in aging provided the first U.S. estimates on the population prevalence of behavioral and mental disturbances in individuals with dementia (Lyketsos et al., 2000). All participants were screened for dementia and underwent extensive neuropsychiatric examinations. Participants were evaluated using the Neuropsychiatric Inventory (Cummings et al., 1994). The study found behavioral and mental disturbance in 70-80% of all dementia cases (Lyketsos et al., 2000). In nursing homes 65% of dementia patients exhibit behavioral symptoms and these symptoms are often the cause of nursing home placement (Neistein & Siegal, 1996).

Table 3: Functional Assessment Stages in Normal Aging and Alzheimer's Disease

Global Deterioration Scale Stage	Clinical Diagnosis	Functional Assessment Characteristics
1. No cognitive decline	Normal	No functional decrement.
2. Very mild cognitive decline	Normal for Age	Complains of forgetting location of objects.
3. Mild cognitive decline	Borderline impairment	Decrease in functioning in demanding work settings; difficulty in new locations.
4. Moderate cognitive decline	Mild AD	Decreased ability to perform tasks. (complex tasks)
5. Moderately severe cognitive decline	Moderate AD	Requires assistance in clothing; may require coaxing to bathe.
6. Severe cognitive decline	Moderately severe AD	Requires total assistance in dressing, bathing, and toileting.
7. Very severe cognitive decline	Severe AD	Limited ability to speak, loss of ambulatory ability, loss of ability to sit up, smile, hold head up; total care needed.

Note. This material adapted from Reisberg et al. (1987).

Behavioral and mental symptoms tend to occur in later stages as the previous section mentioned. Often behavioral disturbances are a result of an underlying mental condition.

Depression often accompanies AD early in the disease (Terry & Wagner, 1992). After the diagnosis of AD has been made, it is still important to consider depression as a possible co-morbid condition and have it diagnosed. There are multiple benefits to the AD patient and family by having depression diagnosed. Most relevant is that depression can cause additional dysfunction in the AD patient. Antidepressants have been shown to be effective and reduce the disability and improve overall functioning (Alexopoulos, 1996). In the Cache County aging study, apathy was the most commonly reported disturbance among AD patients and family members. Depression and/or agitation were found in 1 out of 4 of the participants in this study (Lyketsos et al., 2000).

Hallucinations, either auditory or visual in nature, are a symptom found in Alzheimer's disease. The most common hallucinations are seeing things or hearing voices, although patients have been known to feel, smell or taste things as well (Mace & Rabins, 1991). Psychiatric disturbance is common in AD, however, the inability to reason and appropriately interpret sounds may increase the patient's likelihood of experiencing hallucinations. Delusions, which are false ideas believed by a person, often stem from these hallucinations (Gruetzner, 1992). Delusions in the Alzheimer patient are many times suspicious or self-blaming in nature. These delusions often result from the patient trying to assess their current situation (Mace & Rabins, 1991). Due to memory or reasoning impairment, situations are often misinterpreted. For example, the patient may be unaware who the housekeeper is. Due to memory impairment, the patient only knows they see a stranger in their home and they react to the person as an intruder (Gruetzner, 1992). Misinterpreting the situation can

lead to many of the behavioral issues common in AD such as not eating due to the belief the food has been poisoned.

Motor-related behavioral disturbances such as agitation, wandering, pacing, restlessness and repetitive mannerisms are a result of inappropriate perceptions. Niestein and Siegel (1996) state that the purpose of human behavior is to "adapt to the perceived environment (p. 400)." Dementia patients view their environment through a faulty mechanism, which may cause behavior that is inappropriate. Not all motor related behaviors require treatment or intervention. For example, pacing and repetitive mannerisms such as the rubbing together of hands may distress the caregiver, but do not prove problematic for the patient. Neistien and Siegal (1996) argue that the increased motor behavior may be an attempt by the dementia patient to offset the lack of environmental stimulation. These types of disturbances are more frequently found in Alzheimer patients that have more moderate and severe cognitive impairment (Aronson, Post, & Guastadisegni, 1993). The most frequently cited behavioral problems exhibited by the more severely cognitive impaired patients include the inability to sit or stand still, pacing, and resistance to care such as bathing, dressing, and grooming (Aronson et al., 1993).

Wandering tends to be the most identifiable motor related disturbance associated with Alzheimer's disease. There are multiple explanations as to why the AD patient wanders. Many have to do with the AD patient's interpretation of the environment. For example, Yang, Hwang, Tsai, and Liu (1999) found that Alzheimer's patients with misidentification problems, especially that of "someone is in my house" and "this is not my house", were more likely to wander. Problems with auditory hallucinations and sleep disturbance were also more likely in patients that wander. The main issue with wandering is the harm that can

come to a patient when they get lost or wander into the street. The concern of the patient getting lost is significant as an estimated 40% of AD patients get lost outside of the home (McShane et al., 1998).

Sleep disturbance is found to be high among dementia patients (Alessi et al., 1995). AD patients tend to sleep more during daytime hours and less in the nighttime hours (Meguro et al., 1995). As cognitive impairment becomes more severe, there tend to be more problems with sleep disturbance (Bliwise, Hughes, McMahon, & Kutner, 1995).

Alzheimer's disease affects the ability for a person to carry out normal every day activities. Abilities such as dressing, bathing and eating refer to activities of daily living (ADL) and tasks such as shopping and using transportation refer to instrumental activities of daily living (IADL). There is recent evidence that decline in ADL's and IADL's often present before a diagnosis of Alzheimer's disease is given (Wilms, Kanowski, & Baltes, 2000). An examination of the data from the Berlin Aging Study (Baltes & Mayer, 1999) found that two-thirds of all dementia patients had trouble with the IADL's of transportation and shopping and one-third had limitations including bathing and walking. Grooming and eating appeared to be unaffected prior to diagnosis. When those with dementia also suffered from depression, the numbers jumped to 70% of the patients experiencing difficulty with the IADL's of transportation and shopping. Difficulty with ADL's went to 50% with bathing, climbing stairs, walking and bladder control being most problematic (Wilms et al., 2000). Problems in the areas of ADL's can be experienced in either a decline in areas or excessive behavior in areas.

General loss of social inhibitions may leave an AD patient with little regard for his/her personal appearance. Wearing clothes several days in a row is not uncommon as the patient

may forget how long it has been since they changed clothes (Gruetzner, 1992). All of the choices involved in picking out clothes may also be overwhelming. Other reasons for difficulty in dressing may be the actual task of getting dressed. Items such as zippers and buttons may become difficult to handle (Mace & Rabins, 1991). Dressing in multiple layers of clothing and the wearing of a coat or sweater in 90 degree weather can also be seen with AD.

Bathing is another area that can be problematic in Alzheimer's disease patients. Fear of bathing is a part of the middle stages of dementia. The patient is often labeled uncooperative when they are unwilling to bathe. The fear of bathing is actually based upon legitimate concerns such as forgetting how to adjust water temperature, how to use soap and water and the fear of falling in or out of the tub. The patient has also lost the ability to recognize personal hygiene as important. Social judgment and awareness are severely affected in AD. Another reason for objecting to bathing is the obvious sign of dependence. Many times a patient may not remember the last time they took a bath and just assume it was this morning or yesterday because that was their normal routine in the past (Gruetzner, 1992).

Problems of urine and bowel incontinence are common. Because many medical problems can produce incontinence problems alternate explanations for such behavior should be explored. Other causes of problems with toileting may be that the patient moves too slowly or the patient is unable to identify the bathroom (Mace & Rabins, 1991). Unique toileting issues such as urinating in trashcans and excessive worry about needing to void are also typical.

Eating can be disrupted in different ways throughout the course of the illness. A decrease in appetite is common in AD. A patient may also complain of being hungry all the time or may experience hyperphagia (increased amount and frequency of eating) (Yang et al., 1999), which may be related to not being able to remember the last time he/she ate. The ability to chew and swallow food becomes difficult in the final stages of the illness and this ability is eventually lost (Gruetzner, 1992).

Cognitive Deficits

Memory deficits are the symptom most typically associated with Alzheimer's disease. In the early stages of the illness, patients may complain of difficulty recalling new information, such as recent events or conversation. Learning new material or new procedures present another area of difficulty. The ability to remember short lists, such as for shopping or a daily schedule also creates problems for the AD patient. In the more advanced stages of the illness, memory impairment becomes more severe overall. Simple routines can no longer be followed and new impairments, such as the inability to recognize faces become an issue (Richards & Stern, 1992). In general, memory can be classified on multiple levels; temporal aspects (immediate, short-term, long-term, and remote), type of information being processed (verbal, visual, etc.), or the nature of the processing (priming, encoding, recall, recognition). There is a large body of evidence that supports most all aspects of memory is affected by Alzheimer's disease (Richards & Stern, 1992), as discussed more fully next.

Short-term, or primary, memory refers to the ability to retain information over a very brief period of time, typically one minute or less. The ability to remember new information is highly impaired in AD. Research supports this impairment along with specific

impairments in immediate registration and maintenance of information in working memory. Long-term storage of new information is also impaired in AD. Multiple studies suggest a deficit in encoding and organization of material for long-term storage [see Richards & Stern, 1992, for more information].

In contrast to primary and secondary memory, there is evidence that remote memories remain better preserved in AD. Remote memories refer to the preservation of memories from the distant past. A large portion of remote memory remains intact, at least in the early stages of the illness. However, when AD patients are compared with controls, there is a decrease in remote memory (Cherry & Plauche, 1996). When compared with Parkinson's disease patients, AD patients also show a greater deficit in remote memory (Fama et al., 2000). The current belief is that AD patients have a deficit in their ability to efficiently access remote memories rather than decay of the material involved in remote memory itself (Richards & Stern, 1992).

Research has addressed the areas of episodic and semantic memory loss in AD patients. Episodic memory refers to autobiographical memories; the memories for events that are personally experienced in unique spatial and temporal contexts. Semantic memory refers to a person's knowledge of words and concepts. There is evidence that semantic memory remains more intact than episodic memory in AD patients (Nebes, 1993) [for further review of memory deficits in AD see Cherry & Plauche, 1996, Parasuraman & Nestor, 1993 and Richards & Stern, 1992].

A key symptom of AD is progressive intellectual decline. In the early stages there is a deficit in new learning, spatial disorientation develops, and word-finding pauses in conversations appear. Patients often begin to exhibit poor judgment and difficulty in

reasoning through problems. The later stages can include amnesia syndromes, aphasia, agnosia, apraxia, and delusional thinking. The final stages show intellectual capacities almost completely impaired (Huff, 1988).

Attentional capacity deficits in AD have been explored in a number of studies. The distinction between controlled processes and automatic processes are helpful in pinpointing where the deficits in AD exist. Controlled processes refer to effortful mental operations, such as the intentional use of a strategy to facilitate knowledge acquisition. Controlled processes demand large attentional capacity. In contrast, automatic processes occur without conscious effort (Shriffrin & Schneider, 1977). In the early stages of the illness, the controlled processes are impaired. Automatic processes, which require less attentional processing, do not seem to be affected until the later stages of the illness (Richards & Stern, 1992). AD patients tend to have difficulties with tasks that have a controlled processing component, such as tasks in which unfamiliar material is presented, and tasks involving active retrieval from long-term memory. Patients with AD tend to have less difficulty with tasks that include a more automatic processing component such as vocabulary, reading familiar words and naming familiar objects. These performance differences support the existence of an attentional capacity deficit in AD (Richards & Stern, 1992).

Another area of focus has been in divided verses focused attention. Baddeley's (1996) central executive research found preliminary evidence of a dual-task processing deficit in persons with probable AD. AD patients, in comparison to healthy older adults, had more difficulty performing two tasks simultaneously. A follow up study by Baddeley, Baddeley, Bucks and Wilcock (2001) found similar results as well as support for a fractionated executive control deficit in comparison to a more global central executive deficit. Overall,

AD patients show severe impairments in their ability to divide attention while focused attention appears to remain intact [for further information on attentional issues in AD, see Baddeley, 1996, Parasuraman & Nestor, 1993, & Richards & Stern, 1992].

Huff (1988) describes the nature of language impairment in AD. The presence of language disorder is consistent by the middle stages of AD (Huff, 1988). Specific deficits in language coincide with the different stages of AD. See Table 4 for the typical pattern of progression of language disorder in AD.

Table 4: Typical Pattern of Progression of Language Disorder in Alzheimer's Disease

Early symptoms
Difficulty in finding substantive words Word-finding pauses General vocabulary use due to difficulty in naming objects
Late symptoms
Phonemic (e.g., *log* for *dog*) & Semantic (e.g., *cat* for *dog*) substitution errors Simplified syntax Impaired comprehension
Final symptoms
Meaningless repetition of words Repetition of nonsense sounds Mutism

Note. Adapted from Huff, 1988.

Azuma and Bayles (1997) address the direct relationship memory impairment has on the language abilities of the AD patient. Dementia patients exhibit deficits in auditory comprehension and topic maintenance. Reference errors and the use of sentence fragments

in their spoken language are common. The use and remembering of sentence content is another area of difficulty. Syntactic and phonological knowledge remains intact as evidenced by the grammar and pronunciation of the intact spoken language of the AD patient. Dementia patients keep the ability to read aloud even after the ability to understand such material is lost. AD patients also experience deficits in the meaning of language. These semantic deficits include the inability to use and comprehend meanings of words as well as difficulties in reference and contextual aspects of language (Azuma & Bayles, 1997) [For further discussion of language deficits in AD see Azuma & Bayles, 1997 & Huff, 1988].

Three common symptoms associated with the language deficit are anomia, agnosia, and aphasia. Anomia is impairment in naming. Many times a patient will refer to an item by the name of another member of the item's semantic category. For example a patient may call an apple an orange. The patient may describe what the object does but is unable to retrieve the appropriate word (Huff, 1988). Agnosia is the inability to recognize objects. This inability to recognize often extends to places such as a person's home, and to persons such as family members (Gruetzner, 1992). Aphasia is a problem with speaking and understanding language. Abilities in language comprehension and/or production are gradually lost. There is a decrease in the ability to understand speech and verbally express oneself (Gruetzner, 1992). A study by Yesavage, Brooks, Taylor and Tinklenberg (1993) found an association between early onset aphasia and scores on the Mini Mental State Exam (MMSE). Early onset aphasia is associated with an accelerated decline on the MMSE. This finding is consistent with the idea that early onset of language dysfunction in Alzheimer's disease is associated with a more rapid clinical decline.

Quality of Life in Persons with AD

Due to substantial loss of cognitive functioning and the associated deficits' direct impact on daily functioning, quality of life (QOL) in persons with Alzheimer's disease is an area of great concern. This area has only recently begun to receive attention in the literature. As of the year 2000, Albert and colleagues (1996) had the only published empirical investigation of quality of life and Alzheimer's disease (see Logsdon, Gibbons, McCurry & Terri, 2000 for discussion). Albert et al.'s (1996) study determined that appraisals by family members and caregivers in the nursing home showed a high level of agreement on the AD patient's quality of life. A central reason for the lack of research in this area is the debate over what exactly constitutes quality of life and how having Alzheimer's disease complicates that definition. Logsdon and Albert (2000) report a statement by bioethicists (Buchanan & Bjork, 1989), which referred to the psychological state of the severely demented as more closely resembling that of animals than of normal adults. The prevalent belief that cognitive impairment destroys any sense of personal identity and makes quality of life in this population irrelevant is only now beginning to be widely disputed.

In general, quality of life in Alzheimer's disease has been defined using quality of life ideas that represent non-demented populations. These include domains of spiritual, mental and physical heath, family relationships, social relationships, cognitive abilities, occupational and outside activities, economic success and the vital component of subjective well-being (Brod, Stewart & Sands, 2000). In addition, most measures of quality of life in AD are the result of proxy evaluations by persons such as family members or caregivers, and the patient has not been consulted. As a result, definitions of quality of life in dementia

have been inconsistent and no widely accepted definition has been developed (Howard & Rockwood, 1995).

Recently, Brod, Stewart, Sands and Walton (1999) developed the Dementia Quality of Life Instrument (DQoL), a self-report measure of quality of life for dementia patients. This measure includes the following ten domains to conceptualize quality of life in dementia; (a) Physical Functioning: ability to perform basic physical activities such as walking, bending, etc., (b) Daily Activities: ADLs and IADLs, (c) Discretionary Activities: performance in activities such as hobbies, vacations, being active and productivity, (d) Mobility: ability to travel out of the house, (e) Social Interaction: social relationships, (f) Interaction Capacity: ability to interact wit the environment, communicate and comprehend, (g) Bodily Well-Being: symptoms and bodily states reflecting physical comfort, discomfort, (f) Sense of Well-Being: positive and negative emotional/affective states and perceptions of self, (g) Sense of Aesthetics: sensory awareness, enjoyment/appreciation of beauty/nature, awareness and appreciation of surroundings, and (h) Overall Perceptions: summary of ratings and evaluations about one's health and overall life situation. The development and use of this measure creates a foundation for the assessment of quality of life by the patients themselves, which has been lacking in the dementia quality of life literature. Furthermore, the use of a self-report measure of QOL, administered in conjunction with interventions for the dementia population, would allow for investigation of the impact interventions may have on patient quality of life.

Interventions

Generally speaking, memory improvement techniques that are efficacious for older adults have not proven successful with the Alzheimer population (Yesavage, 1982).

Overall, Alzheimer's patients have shown little benefit from memory interventions, such as those techniques that rely on organizations or association, which are often used with other populations. Yesavage (1982) looked at the effectiveness of memory training and degree of cognitive impairment as measured by the MMSE. Scores on the MMSE can range from 0 to 30 with a score of 0 being the most cognitively impaired to a score of 30 being cognitively intact. Those patients with scores of 18-24 on MMSE showed some improvement with the use of mnemonics but there was no evidence of practical improvement. Participants with MMSE scores of 18 and below did not benefit from the memory training at all. Hill, Yesavage, Sheikh, and Friedman (1989) found mental status is positively related to memory performance changes. This study used two types of visual–imagery mnemonics. Persons with higher MMSE scores (29 and 30) show increased improvement on name-face recall. Patients with MMSE scores lower than 29 showed only minimal improvements. Even persons with only mild cognitive impairment are not likely to benefit from these memory-training techniques.

The minimal improvements of AD patients utilizing interventions that have been successful with the normal population have prompted preliminary work into other possible approaches. The use of external memory aids such as diaries, reality orientation boards and signposts have been helpful in assisting dementia patients to recall personal information and orientation facts (for review see Butter, Soety & Becker, 1997). A modification of reality orientation, Question-Asking Reading (QAR), has Alzheimer's patients participating in a reading group answer direct questions about a story that is read to the group. An initial study by Stevens, King and Camp (1993) found the QAR intervention to improve retention of story content and increased verbal interactions among group members (for review see

Camp & Mattern, 1999). There has also been a pilot study exploring the use of the Montesorri technique in an intergenerational program with Alzheimer's patients and preschoolers (Camp et al., 1997). This technique involves pairing an AD patient and a preschool child together for engagement in Montessori type activities such as sorting, matching, and phonics, to name a few. Alzheimer's patients were found to demonstrate a higher level of functioning when involved in the program in comparison to when they were not involved. Another intervention demonstrating promise is the spaced retrieval technique.

Spaced retrieval (SR) is a technique used to aid mnemonic function. Spaced retrieval utilizes shaping procedures and applies them to the acquisition and retention of information in memory (Abrahams & Camp, 1993). In spaced retrieval, information is learned and retained by making active recall attempts over increasingly longer periods of time. A person is taught a piece of information (e.g. a name) and repeatedly tested at retention intervals that systematically lengthen over successful recall trials. If the person correctly recalls the information the retention interval is increased. If the person is unsuccessful in their recall attempt, the information is restated to them and the next retrieval interval is reduced to the previous interval (Camp, Foss, O'Hanlon, & Stevens, 1996).

Landauer and Bjork (1978) were the first to develop this methodology using a college student population. Students were presented with a fact once and then tested using multiple spacing patterns. The results indicate the expanding interval pattern provided the largest benefit. The term spaced retrieval refers to the expanding pattern of retrievals that was found to be most advantageous. Schacter, Rich, and Stampp (1985) extended this work with persons suffering from memory disorders as a result of aneurysm and amnesia from encephalitis. Their results showed memory disorder patients could learn new information

from utilizing the spaced retrieval technique. These initial studies provided the basis for using the technique with a variety of dementia populations. More recently, Cull, Shaughnessy and Zechmeister (1996) produced a series of experiments that added to the early literature of this strategy hoping to stimulate additional research in applied areas such as interventions.

The theoretical basis of SR is believed to incorporate various principles from multiple disciplines. First, the intervention may be based on the spacing effect. The spacing effect refers to the benefit of information studied over separate trials in comparison the same information studied in repeated massed trials (Green, 1992). The spacing effect has been demonstrated consistently in explicit memory tasks. Support of the benefit from the spacing effect in the implicit memory literature is less consistent. Green (1990) performed a series of experiments addressing spacing effects on implicit memory tasks. Results were mixed. Spacing effects were found on three implicit memory measures: spelling of homophonic words, word-fragment completion and perceptual identification. However, the effect was not found in perceptual identification when information was studied incidentally or between lists when spacing was controlled. Other studies have also failed to produce large spacing effects on implicit memory tasks (see Jacoby & Dallas, 1981 and Perruchet, 1989). Given that spaced retrieval is believed to work implicitly (Camp, Bird & Cherry, 2000), the question of whether the spacing effect is contributing to the memory gains in this intervention is questionable.

SR also incorporates the shaping procedure from the behavior modification literature. Shaping involves the reinforcement of consecutive events to obtain a desired behavior. In spaced retrieval, the shaping procedure is applied to memory and the target behavioral

outcome is long-term retention of the to-be-remembered information. From this perspective, one theoretical basis of the spaced retrieval intervention is learning theory (Camp & Mattern, 1999).

In addition, spaced retrieval relies upon the principle of "errorless learning" from the neuropsychological rehabilitation literature (Baddeley & Wilson, 1994). Errorless learning comes from Squires' account that there are two unique learning/memory systems; declarative memory which refers to conscious learning and retrieval, and procedural or nondeclarative memory that utilizes well-learned processes and works unconsciously in acquisition and retrieval (Squire, 1994). It is believed that persons with memory disorders learn new information through the use of unconscious learning (Camp & Mattern, 1999). However, for retention of the new information to occur, participants much be exposed to and practice the new items. Due to deficits in memory, these patients cannot rely on past experience as a basis for correcting errors made during new learning. They must not be allowed to make errors or inaccurate learning will take place. This is why it is important for success to be incorporated into the SR procedure and why each trial must end with a correct recall (Camp & Mattern, 1999).

There are many benefits of spaced retrieval as a technique for older adults with probable AD. One benefit is that the technique is utilized in the context of a social visit, which creates a positive experience for the patient. Another advantage is the simplicity of the paradigm itself. The time intervals in spaced retrieval are basically a form of shaping the desired response, as previously mentioned. Even in failure the intervals are easily adjusted to ensure the patient achieves success. The spaced retrieval intervention appears to work without conscious effort in that the patient learns with minimal effort, which is another

benefit (Camp & Stevens, 1990). In addition to the many advantages, the technique has also proven to be a successful intervention for persons with AD across a variety of stimuli and tasks.

Camp et al. (1996) had success in teaching patients with MMSE scores from 11–26 to use a calendar. The majority of participants learned to use the calendar without assistance from a caregiver in 2-3 training sessions (61%), and an additional 26% learned the strategy after 4 sessions. The intervention was designed to teach patients to look at the calendar every day and read the task they were to perform (e.g. take out the garbage). Participants were also asked to sign the calendar after they had read the daily task. A large percentage of patients (81%) learned to sign the calendar after usage. The study follows usage for 1 week but many participants continued with the calendar usage well after the study had finished (see Camp et al., 1996).

McKitrick, Camp, and Black (1992) found that dementia patients were able to successfully complete a prospective memory task after training with the spaced retrieval technique. The task involved the participants selecting a colored coupon and giving it to the experimenter after a one-week delay. The patients were successful on the task and were also able to make changes within the task such as remembering to give the experimenter a different colored coupon. McKitrick et al.'s study supports that spaced retrieval is successful in teaching dementia participants prospective memory tasks as well as successfully teaching a change task requirement (McKitrick et al., 1992).

The spaced retrieval method has proven successful in aiding older adults with probable Alzheimer's disease with remembering names of common objects. In Abrahams and Camp (1993), patients were trained using the spaced retrieval method to recall common objects.

Patients were shown a target item and asked to state the name. If they could not name the item they were given the correct name and immediately asked to repeat the label. By the end of the first day, one participant had 5 errors in 25 trials. Two weeks later, the participant was able to recall the target item at the beginning of the training session. The patient was also capable of identifying a colored drawing of the item. Another successful participant demonstrated 3 errors out of 22 trials at the end of the first day and at 2 weeks was able to name the target item at the beginning of the session (Abrahams & Camp, 1993).

Cherry, Simmons, and Camp (1999) also found spaced retrieval to be effective in aiding the recall of everyday objects. Participants were trained utilizing the spaced retrieval method to identify a target object out of a group of objects. The participants were considered successful if they were able to pick the correct item and hand it to the experimenter on cue. Spaced retrieval produced within and across training session benefits. Final retention of the participants was increased from 3 to 5 times that of retention in the first trial.

McKitrick and Camp (1993) found spaced retrieval useful, for not only recalling previously known objects, but also learning the names of new objects. A caregiver trained a woman experiencing anomia in the spaced retrieval technique. This woman scored a 14 on the MMSE, indicating sizeable cognitive impairment. The woman had 10 weekly visits that lasted approximately an hour. The target objects were the names of familiar objects from the Boston Naming Test (Kaplan, Goodglass, & Weintrub, 1983). In addition to these objects, the patient was taught to remember personal names she had forgotten such as her favorite tree's name, table lamp and her caregiver's name. The participant was also able to learn the name of a new item, a computer floppy disc. The results of this intervention were

an overall success in that all trained items were learned and produced with greater consistency than before spaced retrieval training was implemented.

Alexopoulos (1994) utilized the spaced retrieval technique to discontinue a patient's inappropriate sexual behavior. Spaced retrieval was used in treating a patient with severe cognitive impairment (score of 8 on the MMSE) who was exhibiting sexually inappropriate behavior that included touching and verbal remarks to female patients and staff members. The participant was given a written statement that said "Ward rule: No touching females on the ward." The staff would ask him to read the note and then was questioned about the rule. After spaced retrieval training was implemented the behavior eventually stopped. It became unnecessary to ask the patient to read the rule (Alexopoulos, 1994).

Spaced retrieval has been used in combination with fading cues to achieve success in discontinuing several problem behaviors found in Alzheimer's disease. Bird, Alexopoulos, and Adamowicz (1995) describe fading cues as graded cues sequentially given to the participant on each learning trial until retrieval occurs. The cue levels are slowly decreased or faded across trials and memory trace is consolidated. The cue is designed to assist in the recall of practical information. Many times interventions with AD participants prove unsuccessful because the patient never learns the association between the cue and object or behavior. For example, a door painted red is supposed to act as a cue for the restroom. This intervention is useless if the participant is never capable of understanding what the red door means. This study taught participants to associate a specific cue with a behavior or with information that was intended to modify behavior utilizing the spaced retrieval method. The first participant was taught to associate a cue, a large colored sign, with the location of the toilet. The participant had been voiding in inappropriate places. The intervention was a

success and inappropriate voiding was no longer a problem. The second participant had aggressive and disruptive behavior such as wandering into others' rooms and taking others' belongings. In a single two-hour session, the participant was taught that a red stop sign means to stop and walk away. Daily entries into others' rooms dropped from an average of 43 to 2 per day. The third participant had a fear of soiling himself. He was taught to associate a beeper going off to signal the time to go to the bathroom. The participant slowly progressed to 2-hour intervals of the beeper. At follow up a year later the participant continued to use the beeper and displayed no anxiety in between trips to the restroom.

Recent research has explored the long-term effectiveness of the SR training paradigm. Cherry and Simmons-D'Gerolamo (2004) trained two subjects via SR to remember objects. One participant was retested at 18 months and the other was retested at 24 months. When compared to matched controls that had no prior SR training, there was little evidence of the effects of prior training on spaced retrieval performance. Findings here suggest that 18 and 24 months are too long to observe the benefit of the SR intervention. Another study by Cherry and Simmons-D'Gerolamo (2005) addressed the long-term effectiveness with SR at time intervals of 11 to 12 months. Results showed participants trained via SR benefited from prior training at time of retest, especially in the first three re-test SR sessions. In comparison to the control participants, persons with prior SR training exhibited fewer failed trials and longer retention intervals, indicating benefit of prior training.

To date, no studies utilizing spaced retrieval have explored the efficacy of booster sessions to help in maintenance of the learned material. Booster sessions have been explored in clinical treatments to help maintain clinical gains in areas such as adolescent sexual behavior (Pedlow & Carey, 2004), marital therapy (Braukhaus, Hahlweg, Kroeger,

Groth, & Fehm-Wolfsdorf, 2003), Post Traumatic Stress Disorder (Schnurr et al., 2003), Bipolar disorder (Danielson, Feeny, Findling, & Youngstrom, 2004) and smoking cessation (Marlatt, Curry, & Gordon, 2004) to name a few. Results from these studies overwhelming indicate benefits from booster sessions in maintaining gains.

Two recent studies by Hochhalter and colleagues have attempted to compare spaced-retrieval with other training schedules. Hochhalter, Bakke, Holub & Overmier (2004) trained ten persons with Alzheimer's disease or alcohol induced dementia to remember a medication (pill) name. Each participant served as their own control and was trained to associate a medication name with a picture of a pill with either spaced retrieval or uniform retrieval training trials. Results found no participant learned the medication name in the uniform training condition; however most learned in the spaced retrieval condition. Hochhalter, Overmier, Gasper, Bakke & Holub (2005) found conflicting results when comparing spaced retrieval to four other training schedules. This study found spaced retrieval did not produce long-term retention more often than other schedules of practice on either a pill naming or nonverbal sequence task. These results of these studies emphasize the need for further research comparing spaced retrieval to other training schedules.

Name-Face Interventions for Persons with AD

Memory for names and faces is an important part of everyday functioning. Research has shown a deficit in both explicit and implicit memory for faces in persons with Alzheimer's disease (Lemesle, Puel, Demonet & Cardebat, 1998). This deficit creates a need for interventions that can train memory impaired older adults to remember name-face associations.

Kesslak, Nackoul and Sandman (1997) had success in training a group of Alzheimer's patients on name recall. Eleven participants were taught to remember a person's name through the use of a photograph as well as personal information related to the person such as hobbies. The intervention lasted for four weeks and required active participation from a caregiver who would engage in discussion with the patient and provide immediate corrected feedback when they gave an incorrect answer. Participants and caregivers were encouraged to study the pictures and personal information at home and to test each other during the week. AD participants showed an increase in recall of names over the weeks of training.

Clare, Wilson, Carter, Roth & Hodges (2002) had success in training early stage Alzheimer's patients to remember name-face association using an errorless learning paradigm. Twelve participants were taught to remember a familiar name-face association, someone in their social network or a famous face, at a predetermined training schedule. Several participants were able to maintain the memory gains at a 6-month follow up, however individual differences in response to the intervention were observed.

Spaced retrieval has also been used to train persons with AD to remember the names of persons. Camp and Schaller (1989) trained a man with Alzheimer's disease in the spaced retrieval method to remember and utilize a caregiver's name. At a six-month follow up, the patient was consistently calling the nurse by her name. Another study by Joltin, Camp and McMahon (2003) used SR to train a woman with AD over the phone to remember the name of her grandchild using a photograph. The experimenter called the participant and referred to the picture that was placed on her refrigerator prior to training. This participant was trained on the name of the grandson for four sessions. The participant was able to state the grandson's name correctly five days after the intervention had concluded.

A name-face association trained via spaced retrieval was also found to transfer to a live person target. Hawley & Cherry (2004) trained six adults with AD via spaced retrieval to remember an unfamiliar name-face association and transfer that learning to a live person target. Participants received six training sessions over a two-week period. On each trial, participants selected a target photograph and stated the target name, from eight other photographs, at increasingly longer retention intervals. Results showed all participants were able to select the target photograph and state the target's name for longer periods of time within and across training sessions. A live person transfer task was administered to determine whether the name-face association, trained by spaced retrieval, would transfer to a live person. The live person target was the same target that was used in the spaced retrieval training sessions. Half of the subjects were able to call the live person by the correct name. The others were able to identify the live target's picture from among the distractors.

SPECIFIC AIMS

Steady decline in cognitive functioning is an irreversible symptom of Alzheimer's disease. However, there is growing evidence to suggest that it is possible to implement memory interventions that build on the remaining cognitive abilities of persons with AD. The spaced retrieval technique has proven to be a successful memory intervention with AD patients (Camp, Bird & Cherry, 2000). Spaced retrieval has shown to be useful in learning new information and recalling that information over significant periods of time. Specifically, the intervention has been used to train AD patients on name-face associations. Camp and Schaller (1989) successfully used spaced retrieval to train an AD patient to remember his caregiver's name. In addition, Hawley and Cherry (2004) had success in training patients on a non-familiar name-face association and then transferring that association to a live person. The current research was designed to build upon the successes of spaced retrieval training and provide further evidence of the flexibility and success of the paradigm as an important intervention for use with the Alzheimer's population.

There were four main objectives in the present research. The first goal of these studies was to conduct a spaced retrieval experiment that included a control group with constant retrieval intervals, to determine if the expanding spacing intervention is in fact contributing to the learning of new information. The second goal was to examine the effectiveness of booster sessions in facilitating long-term maintenance of the spaced retrieval intervention. The third goal of the current research was to demonstrate the adaptability of the technique for use with a familiar name-face association (e.g. a family member). The fourth goal of the present studies was to explore non-cognitive benefits of spaced retrieval training,

specifically quality of life for the patient. These four goals are discussed in more detail in the sections that follow.

The first aim of the proposed studies was to conduct a spaced retrieval experiment that included a control group that received an equal number of training trials on a fixed interval retrieval schedule, which was necessary for conclusions about the contribution of the spacing effect on new learning in this intervention. To date, most studies involving the spaced retrieval paradigm as a memory intervention for persons with dementia have not included a control group. The lack of a comparison group represents a serious gap in the intervention literature, as it has not been demonstrated that it is the spaced retrieval intervention that is responsible for the learning and improvement in these studies. Utilizing a design that included a control group, I expected that those in the adjusted spaced retrieval group would perform better than those that were in the fixed interval retrieval schedule. This prediction was based on previous success of AD participants in SR studies (Hawley & Cherry, 2004, Cherry & Simmons-D'Gerolamo, 2005) as well as findings from the memory literature (see Landauer & Bjork, 1978; Cull et al., 1996). I expected that the results would confirm that the spacing is contributing to the learning and improvement observed in spaced retrieval, and not mere repetition of trials alone.

The second aim of the proposed research was to examine the efficacy of supplemental training sessions to enhance the long-term maintenance of the intervention. Cherry and Simmons-D'Gerolamo (2005) found benefits of prior spaced retrieval training on retest at intervals as long as eleven months, but not longer than 18 months. The current studies examined the effectiveness of adding supplemental training sessions during the time between original test and retest at six months. I expected to find that participants who

received 'booster' sessions performed better than the participants who received no additional training at retest, as evidenced by fewer failed trials and longer retention intervals at retest.

I expected to demonstrate the flexibility of the spaced retrieval intervention by using a familiar name-face association, which was the third aim of the study. Hawley and Cherry (2004) found that spaced retrieval could be successful in training an unfamiliar name-face association. In addition, the intervention proved to successfully transfer to a live person from a picture. In the current studies, I used the same methods and procedures as Hawley and Cherry (2005), however, the target was a person familiar to the patients. I expected that the results would replicate Hawley and Cherry (2004), in that participants would learn or re-learn a familiar name-face association and transfer that knowledge to a live person target. In addition, I expected participants would master the name-face association more quickly with a familiar target than with an unfamiliar target. This prediction was based on previous findings from work with familiarity and famous face recognition. To be precise, Bartlett and Fulton (1991) found that older adults rely on perceived familiarity (similarity to face recognition in memory) to recognize faces more often than younger adults. In addition, work by Backman and colleagues (1998) found that older adults with AD recognized photos of dated famous faces more often then photos of more current famous faces. This literature would suggest that AD participants should be able to learn and retain a familiar face more quickly than a non-familiar face via spaced retrieval training. Finding that SR training is adaptable for use with familiar name-face associations would have significant implications for Alzheimer's patients and their families.

The fourth aim was to explore non-cognitive benefits of SR, specifically the impact on participant quality of life (QOL). To date, no research has empirically explored the potential

non-cognitive benefits of spaced retrieval. Davis, Massman and Doody (2001) found that quality of life did not improve for Alzheimer's patients as a result of a cognitive intervention that included training in name-face associations, spaced retrieval and cognitive stimulation. However, Davis et al. measured quality of life by caregiver reports and not patient self-report. In addition, the cognitive intervention did not include spaced retrieval training alone but rather as a part of the overall intervention. Only a subset of the participants, 15 of the 37 participants in the 'intervention' condition, received the SR training, therefore it is difficult to draw conclusions about the generalizability of spaced retrieval training gains to AD patient quality of life when less than half the participants received SR training and SR was administered in combination with other interventions. In the current study I utilized the DQoL, a measure designed to determine a dementia patient's quality of life through patient self-report (Davis et al., 2001). I expected that scores on the DQoL might show higher levels of quality of life after spaced retrieval training, a finding that could be interpreted to suggest that SR has social benefits to the participant as well as cognitive benefits.

OVERVIEW OF EXPERIMENTS

Three experiments addressed the goals outlined in the specific aims. Specifically, experiment one was designed to address goal one and determine the contribution of the spacing effect in the spaced retrieval intervention. This experiment trained a group of six persons with AD via spaced retrieval to recall a non-familiar name-face association. This experiment also included a control group of six persons with AD that received a fixed interval retrieval training schedule with the same number of test trials. Including this control group allowed for direct comparison with the spaced retrieval group and thereby permits inferences on the role of the spacing effect in the spaced retrieval paradigm.

Experiment two was designed to determine the effectiveness of additional training sessions on the long-term effectiveness of the intervention, which is the second goal of this study. In experiment two, all participants had been trained with spaced retrieval to remember a non-familiar name-face association (i.e., the six SR participants from Experiment 1). I administered booster sessions to half of the participants while the other half received no additional training and both groups were retested at a six-month interval. This experiment allowed information to be gained about the benefits of including supplemental training sessions, which I hypothesized would promote the long-term effectiveness of the intervention.

In Experiment three I explored the use of the spaced retrieval method in training a familiar name-face association. This experiment was designed to address goal three of our project. I trained a group of five new persons with probable AD to remember a familiar name-face association (who have had no prior SR training). Family members were recruited to help determine the appropriate person to serve as the 'familiar' face for each AD patient.

Goal four was addressed in all three studies. I included a measure of quality of life before and after training in each experiment with each group, regardless of their treatment condition. I also administered the quality of life measure to participants' caregivers both before and after training to get a proxy report of participant quality of life. I looked at the change in DQoL scores administered before training and administered after training for each participant and their caregivers. Including the DQoL measure in all experiments allowed for insight into the impact spaced retrieval may play in quality of life in older adults suffering with Alzheimer's disease. Method details for all experiments are explained in the sections that follow.

GENERAL METHOD

Participants

A total of 19 persons with probable AD were recruited from local Baton Rouge adult day care centers and long-term care facilities. All participants had a chart diagnosis of adult dementia and met the DSM IV (American Psychiatric Association, 1994) criteria for dementia of the Alzheimer's type. On the Global Deterioration Scale (Reisberg, Ferris, deLeon, Crook, & Hayes, 1987), participants were representative of Stage 4 to 5 dementia which is considered mild to moderate AD.

Individual Difference Measures

To obtain a cognitive profile of each participant, the following measures were completed: the Mini Mental State Exam (MMSE), the Geriatric Depression Scale (GDS), short-form of the WAIS, and a series of subject-performance tasks. Table 5 contains a summary of all measures of individual differences administered to each participant.

Procedure

Individual sessions were conducted in a private area at the care center. A total of twelve individual training sessions were conducted with each participant. All sessions were held on three alternate days of the week, across a four-week period. The sessions lasted for approximately one hour or until the participant expressed fatigue. The sessions were conducted as described next. For all participants, informed consent was obtained from the patient's legal guardian in advance of their participation in the study.

Table 5: List of Individual Difference Measures Given To Participants

Measure/Reference	Purpose
Mini-Mental State Exam (MMSE) Folstein, Folstein & McHugh, 1975	Cognitive screening measure
Geriatric Depression Scale (GDS) Yesavage et al., 1983	Affect screening measure
Vocabulary test, short form Jastak & Jastak, 1965	General intellectual functioning
Forward Digit Span (FDS) (WAIS, 1955)	Short-term memory
Backward Digit Span (BDS) (WAIS, 1955)	Working memory
Subject-performed tasks (SPT) Cherry, Simmons & Camp (1999)	Secondary memory measure

Baseline Measures of Memory

Two secondary memory tasks were given at each training session; the prospective nametag task and the shirt color task. The prospective nametag task was administered to provide a baseline measure of memory to perform a simple association, a motor response to a verbal cue, without the benefit of spaced retrieval training. The purpose of the shirt color naming task was to obtain a baseline measure of delayed recall (48 hour) of a single piece of information, the shirt color from the previous session, without the benefit of spaced retrieval training. These tasks are described in more detail next.

Prospective Nametag Task. The nametag task was introduced at the beginning of the first session and included at the beginning of every session thereafter. Both the

experimenter and the participants were given a nametag that was worn during each session. The participants were asked to give their nametag back to the experimenter at the end of each session. The participants knew it is the end of the session when the experimenter stated, "We are finished for the day." The participants were asked to repeat the instructions back to the experimenter to ensure understanding of the task. If the participants did not spontaneously hand in the nametag when they heard the cue phrase, the experimenter then implemented a series of prompts.

The nametag task was scored as follows. If the participant remembered to turn in their nametag when the experimenter stated the cue phrase, "We are finished for the day," 4 points were awarded. If the participant turned in their nametag after the cue phrase, "We are finished for the day" had been repeated, 3 points were given. If the participant turned in their nametag only after the experimenter touched their own nametag (a cue) and repeated the cue phrase a third time, 2 points were awarded. If the participant turned in their nametag only after the experimenter first touched their own nametag (a cue), repeated the cue phrase a fourth time and took off their own nametag, 1 point was given. If the participant did not remember to turn in their nametag after all of the above cues were given, 0 points were awarded. The experimenter then asked for the participant's nametag and asked if they remembered what they were suppose to do when they heard the cue phrase, "We are finished for the day." Each day the participant's responses were recorded and a score awarded. A total score was calculated by summing scores across all twelve days.

Shirt Color Naming Task. At the end of each training session, the participant was told to remember the color of the shirt that the experimenter was wearing that day. The experimenter was always wearing a different plain colored shirt (e.g., black, white, red, and

blue) in each session and told the participant the color of the shirt. The participant was informed to report the color of this shirt to the experimenter at the beginning of the next session. Participants were asked to repeat the instructions to ensure they understand the procedure. At the beginning of the next session if the participant did not spontaneously report the color of the shirt worn by the experimenter in the previous session, the experimenter prompted the participants to see if they remembered the task. If the participants were still unable to recall the color, they were prompted to specifically name the color of the shirt. This baseline measure of memory was scored as pass or fail. All prompts and responses were recorded.

Summary of Spaced Retrieval Training Program

Materials. Nine color photographs of faces, taken from a church pictorial directory, were used as stimuli in the experiment. The pictures were of adults in an age range from twenties through fifties. Race was held constant to avoid the memory strategy of recalling the target picture based on race alone. Gender was varied to ensure the task difficulty level was not extreme. One of the photographs was designated as the target item for all participants and the other 8 were distractor items. The pictures were laminated and mounted on a 6-x 6-cm piece of foam board to ensure ease in picking up the photos. The photos were presented on a flat wooden board (29-x 29-cm) with scored lines to represent a 3 x 3 matrix.

Training Sessions. The spaced retrieval training sessions were conducted as follows. First, the experimenter chatted informally with the participant at the beginning of each training session to establish rapport. Next, a 3 x 3 matrix was placed on the table in front of the participant. The experimenter presented the pictures individually, naming each one (e.g. "this is Bob") until all 9 pictures were placed on the board with one photo in each position

on the matrix. The participants were then introduced to the sound of the beeper. This was done to ensure all participants were able to hear the sound that they would be trained to respond to during the upcoming trials.

The participants were told to select the "correct" picture and give it to the experimenter on cue. For example, "When the buzzer sounds, I want you to hand me the picture of Johnny and tell me his name is Johnny." A correct target response consisted of a visual cue (selecting the correct picture), a motor response (handing it to the experimenter), and a verbal response (stating the target's name). This trained the association of the visual cue with the motor and verbal response. All three responses had to be demonstrated within a trial in order for the trial to be considered successful. After each recall trial, the position of the correct target item was changed to ensure that participants were learning the name-face association, and not merely the spatial location of the picture. The time limit for the trials was set at 30 minutes or until the participant expressed fatigue.

The spaced retrieval technique was used to train this target response. A hand held stopwatch was used to control the trials utilizing the following retention interval schedule: the first retention interval was five seconds. If successful, the following intervals were 10, 20, 40, and 60 seconds. After a successful 60-second retention interval was demonstrated, retention intervals were increased by 30 seconds, contingent on a successful recall. After a 180-second (3 minute) retention was demonstrated, the intervals were expanded by 60 seconds following each successful recall. After a 360 second (6 minute) retention was demonstrated, the intervals were expanded by 120 seconds (for more details, see Cherry & Simmons-D'Gerolamo, 1999). During longer retention intervals the experimenter engaged in general conversation, unrelated to the name-face task, with the participant.

Explicit Memory for the Trained Object

Three different measures of explicit memory were administered to measure the participants' retention of the name-face association trained by the adjusted spaced retrieval or fixed interval retrieval method. These included: a) immediate recall and recognition of the trained name-face association (within session explicit control task), b) 48- hour delayed recall of the trained name-face association (from one training session to the next), and c) final recall and recognition of the name-face association across the three training sessions (recall of the association across sessions). A more detailed description of these tasks follows.

Immediate Recall/Recognition. At the end of each training session participants were asked to recall the person's name that they had just been trained on. If the participant was unable to recall the person's name then all nine pictures were placed on the table in front of the participant. The participant was then asked to identify which picture they had been working with that day. All responses were recorded.

Delayed Recall. At the beginning of the session, following a training session, participants were asked to recall the picture they had worked with in the previous session. The delayed recall task was designed to determine whether the participants were able to remember the target picture from the session before. If participants were able to recall the target picture, this would be evidence that spaced retrieval training maintains over time. A score of 0 was assigned if participants were unable to recall the target, whereas a score of 1 indicated the participant successfully recalled the target. The target picture was not presented for recognition after delayed recall, as doing so may have confounded the final

recognition measure by having repeated exposures to the trained target after the initial spaced retrieval training session.

Final Recall/Recognition. The final delayed recall was administered on the session following each completed week of training (session 6, 9 and 12). This task determined whether or not participants were able to recall or recognize the target person used during the previous week of training. If participants were unable to recall the target person then all nine pictures were placed in front of the participant. Participants were told to identify the person they had been trained on the previous week. All responses were recorded.

Live Person Transfer Task

In sessions 5, 8, 11 and 12 the live person transfer task was administered to determine whether the name-face association trained during the spaced retrieval sessions transferred to an actual person. The "live" person was the individual whose picture served as the target picture during spaced retrieval training, as in the Hawley and Cherry (2004) methodology. This "live" person target entered the room, handed the experimenter a phone message and sat in an empty chair at the testing table. The experimenter gave the participant an opportunity to spontaneously recognize the live person target. This task was considered Recall Task #1.

If the participant gave no response, the experimenter implemented Recall Task #2 which consisted of the following prompt. The experimenter stated, "This is my friend, do you know his/her name?" If the participant said no or did not respond, the experimenter moved to Recognition Face, which includes a further prompt. The experimenter said, "Her picture is on the board. Would you hand me her picture?" If the participant still did not appear to recognize the target picture as the live target person, one final recognition task was

given (Recognition Name). The experimenter handed the participant the correct picture, if they had not already selected it, and said "Take another look at the picture, now can you tell me her name?" All responses were recorded.

Final Face Recognition Task

On the last day of the experiment (session 12), participants were given a chance to identify all pictures that have been used as stimuli in the spaced retrieval training sessions. This task was included as a manipulation check to determine whether participants would remember facial pictures given only exposure to the stimuli during the spaced retrieval training. All nine photographs from the training sessions, as well as nine new photographs the participants have not seen before, were placed on the table. Participants were informed that some of the pictures they have seen before, while others are new pictures that they have not seen before. The participants were asked to hand the experimenter the photographs that they have seen before in previous sessions. All responses were recorded.

Dementia Quality of Life Questionnaire

The Dementia Quality of Life (DQoL), a patient self-report measure, was administered to assess the Alzheimer participant's quality of life (Brod et al., 1999). The measure was given to participants before they began the training program (pre) and after they finished the training program (post). The DQoL contains five scales and one overall quality of life rating: (1) self-esteem, (2) positive affect / humor, (3) absence of negative affect, (4) feelings of belonging, (5) sense of aesthetics. Each scale, as well as the overall rating, contains a score range from 1 to 5, with higher scores indicating higher participant quality of life. The DQoL was also administered to participant caregivers both before and

after training to provide a proxy evaluation to supplement the patient evaluation of quality life.

Quality of Experiment Participation in Study Questionnaire

During the final session of the experiment, participants were asked to rate the quality of their experience during participation in the study from six questions. The questions were designed to gain insight into how well the participant enjoyed the process and the interaction with the experimenter. The questionnaire was designed in a format similar to the DQoL for ease in obtaining patient responses (see Appendix A). The questionnaire contained 6 questions and participants indicated how much they enjoyed certain aspects of the study on a five point rating scale where 1 = not at all enjoying, 2 = enjoying a little, 3 = enjoying some, 4 = enjoying quite a bit, 5 = enjoying something a lot. The mean score was then calculated to give an overall quality of participation in the study score. A higher score indicates higher enjoyment for participation in the training.

Data Analysis Plan

These data were analyzed in the following manner. In Experiment 1, independent samples *t* tests were conducted to determine group differences between adjusted spaced retrieval training and fixed interval retrieval training on training performance, free recall (immediate, delayed, final delayed) and the final face recognition task. The live person transfer data was analyzed using Cochran's *Q* to determine differences over the weeks of training on the task by each group. Group differences on the pre (before training) and posttest (after training) scores on the Dementia Quality of Life Questionnaire (DQoL) were analyzed using an independent samples *t* test. Pre and posttest differences on the DQoL between participants and caregivers were analyzed using an independent samples *t* test.

In Experiment 2, independent samples *t* tests were conducted to determine group differences between booster and no booster group on retest training performance and free recall (immediate, delayed and final delayed). The live person transfer data was analyzed using Cochran's *Q* to determine differences on the three transfer tasks by each group. Group differences on the pre (after initial training) and posttest (at 6-month retest) scores on the Dementia Quality of Life Questionnaire (DQoL) were analyzed using an independent samples *t* test.

In Experiment 3, the live person transfer data was analyzed using Cochran's *Q* to determine differences over the weeks of training on the task. Pre (before training) and posttest (after training) scores on the Dementia Quality of Life Questionnaire (DQoL) were analyzed using an paired samples *t* test. Pre and posttest differences on the DQoL between participants and caregivers were analyzed using an independent samples *t* test. Statistical analyses were not performed on the nametag task or shirt color task, as these are tasks intended to supplement training data and highlight participant cognitive deficits.

Detailed Summary of the Procedure

As noted earlier, individual sessions were conducted in a private area at the adult day care or long-term care centers on alternate days of the week, across a four-week period. The sessions were conducted as described next (see Table 6 for a summary of each session).

Preliminary Sessions: Day 1: Informed consent was obtained from the participant on the first day and consent was also obtained from appropriate family member prior to training. Three individual differences measures were administered: the FDS, MMSE, and the GDS. In addition, the two baseline measures of secondary memory, the nametag task and shirt-color task were given.

Day 2: On the second day, the shirt-color task was administered first. The prospective memory instructions were then given and the nametags were handed out. Four additional individual difference measures were administered; the BDS, SPT, DQOL and a vocabulary test. The posttest nametag task was given.

Week 1 of Name-Face Training: Day 3-4: The prospective shirt color task and nametag task were given at the beginning of the session. The instructions for adjusted spaced retrieval or fixed interval retrieval training were given and the training trials began. On day 4, the delayed recall task was administered prior to training. After training, immediate recall and recognition and the posttest nametag task were administered. Responses were recorded on prepared sheets.

Day 5: Day 5 included the same procedure as Day 3 and 4 with the addition of the live person transfer task at the end of the session. Following the posttest nametag task, the live person transfer was administered. The "live" person target entered the room and the participant was asked to recall/recognize the target person.

Week 2 of Name-Face Training: Day 6: The prospective shirt-color task and the nametag task were administered. The final delayed recall task was administered for the target picture. Adjusted spaced retrieval or fixed interval retrieval training trials began again for the same target picture. The immediate recall and recognition task and the posttest nametag task were administered. Responses were recorded on a prepared sheet.

Day 7: The two-baseline measures of memory, the prospective shirt-color task and the nametag task, were given at the beginning of the session. Delayed recall was administered prior to training. Adjusted spaced retrieval or fixed interval retrieval training trials began

again and the responses were recorded on a prepared sheet. After training, the immediate recall and recognition task and the posttest nametag test were administered.

Day 8: The procedure for this day was the same as Day 7, with the addition of the live person transfer task following the posttest nametag task. After the nametags were put away, the live person transfer task followed. The "live" person target entered the room and the participant was asked to recall/recognize the target person.

Week 3 of Name-Face Training: Day 9: The prospective shirt-color task and the nametag task were administered. The final delayed recall task was administered for the target picture. Adjusted spaced retrieval or fixed interval retrieval training trials began again for the same target picture. Immediate recall and recognition and the posttest nametag task were administered. All responses were recorded on a prepared sheet.

Day 10: The two baseline measures of memory, the prospective shirt-color task and the nametag task, were given at the beginning of the session. The delayed recall task was administered prior to training. Adjusted spaced retrieval or fixed interval retrieval training trials began again and the responses were recorded on a prepared sheet. After training, the immediate recall and recognition task and the posttest nametag test were administered.

Day 11: The procedure for Day 11 was the same as in Day 10 with the addition of the live person transfer task at the end of the session. After posttest nametag task was completed, the live person transfer task began. The "live" person target entered the room and the participant was asked to recall/recognize the target person.

Final Session: Day 12: As in all previous sessions, the prospective shirt-color task and the nametag task were administered at the beginning of the session. The final delayed recall task followed. The DQoL was then administered. Next, participants responded to a

demographic questionnaire. The final face recognition task and the quality of participation in the experiment questionnaire were administered. After all tasks were completed, the posttest nametag task was given. At the end of the session a "Certificate of Appreciation" was handed out to every participant to express gratitude for the participant's hard work. Lastly, the live person transfer task was presented, as described earlier.

Table 6: Summary of Experimental Procedure

Preliminary Sessions
Day 1:
Informed Consent obtained
Prospective Nametag Instructions
Forward Digit Span (FDS)
Mini-Mental State Exam (MMSE)
Geriatric Depression Scale (GDS)
Prospective Posttest Nametag Task
Shirt Color Instructions
Day 2:
Shirt Color Naming Task
Prospective Nametag Instructions
Backward Digit Span (BDS)
Participant Performed Task (SPT)
Quality of Life (DQOL)
Vocabulary Test
Prospective Posttest Nametag Task
Shirt Color Instructions
Week 1 Name-Face Training
Days 3-5:
Shirt color Naming Task
Prospective Nametag Instructions
Delayed Recall (Days 4 – 5)
Adjusted Spaced Retrieval or Fixed Interval Retrieval Training
Matrix Presented
Instructions Given
Trials

Table 6 continued

Immediate Recall/Recognition
Prospective Posttest Nametag Task
Shirt Color Instructions
*Live Person Transfer Task- Day 5 only

Week 2 Name-Face Training
Day 6:

Shirt Color Naming Task
Prospective Nametag Instructions
Final Delayed Recall/Recognition
Adjusted Spaced Retrieval or Fixed Interval Retrieval Training
    Matrix Presented
    Instructions Given
    Trials
Immediate Recall/Recognition
Prospective Posttest Nametag Task
Shirt Color Instructions

Days 7-8:

Shirt Color Naming Task
Prospective Nametag Instructions
Delayed Recall
Adjusted Spaced Retrieval or Fixed Interval Retrieval Training
    Matrix Presented
    Instructions Given
    Trials
Immediate Recall/Recognition
Prospective Posttest Nametag Task
Shirt Color Instructions
* Live Person Transfer Task- Day 8 only

Week 3 Name-Face Training
Day 9:

Shirt Color Naming Task
Prospective Nametag Instructions
Final Delayed Recall/Recognition
Adjusted Spaced Retrieval or Fixed Interval Retrieval Training
    Matrix Presented
    Instructions Given
    Trials
Immediate Recall/Recognition

Table 6 continued

Prospective Posttest Nametag Task
Shirt Color Instructions

Days 10-11:

Shirt Color Naming Task
Prospective Nametag Instructions
Delayed Recall
Adjusted Spaced Retrieval or Fixed Interval Retrieval Training
    Matrix Presented
    Instructions Given
    Trials
Immediate Recall/Recognition
Prospective Posttest Nametag Task
Shirt Color Instructions
* Live Person Transfer Task- Day 11 only

Final Session
Day 12:

Shirt Color Naming Task
Prospective Nametag Instructions
Final Delayed Recall/Recognition
Quality of Life (DQOL)
Demographic Questionnaire
Final Face Recognition Task
Quality of Experiment Participation Questionnaire
Prospective Posttest Nametag Task
Certificate of Appreciation handed out
*Live Person Transfer Task

EXPERIMENT 1

Participants

A total of twelve participants with mild to moderate AD were recruited from local adult care centers (age range: 76 to 91 years; 4 male, 8 female). All participants met the criteria outlined in the general method including a Mini-Mental State Exam score between 12 and 24. Participants completed the individual difference measures described in the general method. A summary of demographic and health characteristics of the sample is located in Table 7 and Table 8. Table 7 includes information reported by the primary caregivers, while Table 8 information is patient self report information.

The MMSE (Folstein, Folstein, & McHugh, 1975) was used to provide an index of current cognitive status. The maximum score on the MMSE is 30. On this measure, healthy older adults scores range from 27 to 30. For the current sample, scores ranged from 14 to 24, indicating cognitive impairment (see Table 9). To obtain a measure of affective status, the GDS (Sheikh & Yesavage, 1986) was administered. Scores between 6 and 10 on the GDS represent mild depression. The scores from the current sample ranged from 0 to 7, indicating only two participants (S1 and S12) were likely suffering from mild depression at the time of testing (see Table 9).

The short -form of the WAIS vocabulary test (Jastak & Jastak, 1965) was utilized as a measure of general intellectual functioning as well as verbal ability. The maximum score of 40 is possible on the vocabulary subtest. Past research utilizing the short form of the WAIS yielded a mean verbal score of 16.1 for lower education adults and a mean verbal score of 29.7 for higher education older adults (Cherry & Park, 1993). Participant

scores from this sample ranged from 10 to 28, indicating a deficiency in general intellectual functioning and verbal ability. While some of these scores may appear to be high, the education attainment of the sample most likely accounts for this outcome.

The Forward Digit Span and the Backward Digit Span from the WAIS were used to obtain a measure of short-term memory and working memory, respectively. The highest possible score is 9.0 on the FDS and 8.0 on the BDS. On the FDS, the current sample scores were between 4.0 and 7.5, suggesting deficits in short-term memory. Scores on the BDS were between 2.0 and 5.0, suggesting working memory impairment (see Table 9). The pattern observed in the present sample of higher scores on the FDS in comparison with the BDS is also found in populations of healthy older adults.

Lastly, participants were given series of subject-performed tasks adapted form Cherry, Simmons, and Camp (1999) as a measure of secondary memory ability. In this task 10 items were presented and participants were asked to perform a specific action with each item. For example, the experimenter handed the participant a rubber band and said, "Here's a rubber band, I want you to stretch the rubber band." Participants were later asked to free recall the objects and what they did with the object. For items that were not recalled, the object was presented as a cue and participants were asked to describe what they did with the object.

The task was scored based on a strict (i.e., verbatim) and lenient (i.e., verbatim and semantically parallel) criteria for both free recall and cued recall of the objects and the actions. Overall, free recall of the objects and actions were low, regardless of implementing the strict or lenient criteria, as can be seen in Table 9. This finding is consistent with the literature on AD, in that memory impaired persons with probable AD show gross deficits

Table 7: Summary of Demographic and Health Characteristics (caregiver-reported)

	Adjusted Spaced Retrieval						Fixed Interval Retrieval					
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Age	78	76	79	89	91	82	81	85	84	87	75	82
Gender[a]	1	2	1	2	2	1	2	2	2	2	1	2
Race[b]	1	1	1	1	1	1	1	1	2	1	1	1
Marital Status[c]	4	4	2	2	4	4	4	4	4	4	2	4
Years of Education[d]	6	4	4	5	7	5	6	7	6	7	5	4
Occupation Level[e]	5	3	3	3	5	4	5	5	5	5	3	3
No. of chronic diseases[f]	4	2	3	3	3	3	4	4	4	3	3	4
No. of medications[g]	3	3	4	3	4	4	4	3	4	4	3	3

Note. [a]1=male, 2=female. [b]1=white, 2=black. [c]1=single, 2=married, 3=divorced, 4=widowed. [d]1=less than 7th grade, 2=7th - 9th grade, 3=10th – 11th grade, 4=high school degree, 5=partial college or specialized training, 6=college degree, 7=graduate degree. [e]1=unskilled, 2=semi-skilled, 3=skilled, 4=semi-professional, 5=professional. Professions included, homemaker, teacher, librarian, chemist, attorney, electrician and environmental engineer. [f]higher scores reflect more health problems. [g]1=none, 2=1 to 3, 3=4 to 6, 4=over 6.

Table 8: Summary of Health and Social Activity Characteristics (self-reported)

	Adjusted Spaced Retrieval						Fixed Interval Retrieval					
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Self-perceived health[a]	2	1	2	1	1	2	2	4	2	2	2	2
Health prevents activities[b]	1	1	1	1	3	1	1	3	1	1	1	2
Health compared to others[c]	2	2	1	1	1	1	1	1	1	1	2	2
No. of times per week for visitors[d]	2	1	2	4	4	2	3	4	2	3	2	4
No. of activities at facility per week[e]	2	3	4	2	1	2	4	2	4	2	2	2
No. of community activities outside home[f]	2	1	2	2	1	2	2	2	2	3	3	1
No. of hours per week spent outside home[g]	2	1	3	3	1	4	2	1	5	2	3	1

Note. All ratings were made on a 3 to 5-point Likert scale. [a]1=excellent to 4=poor. [b]1=not at all to 3=a great deal. [c]1=better to 3=poorer. [d]higher scores reflect increased number of times. [e,f]higher scores reflect more activities. [g]higher scores reflect more time.

Table 9: Summary of Individual Difference Measures by Group

	Participants													
	Adjusted Spaced Retrieval							Fixed Interval Retrieval						
Measure	S1	S2	S3	S4	S5	S6	Mean	S7	S8	S9	S10	S11	S12	Mean
Age	78	76	79	89	91	82	82.50 (6.16)	81	85	84	87	75	82	82.33 (4.18)
MMSE[a]	14	21	14	22	24	18	18.83 (4.21)	18	19	19	20	14	17	17.83 (2.14)
GDS[b]	6	0	0	0	4	2	2.00 (2.53)	1	1	0	0	1	7	1.67 (2.66)
Vocab[c]	25	21	10	21	28	20	20.83 (6.11)	20	25	10	26	19	19	19.83 (5.71)
FDS[d]	7.0	4.5	5.5	5.0	5.5	5.5	5.50 (0.84)	4.5	7.5	4.0	4.5	5.5	4.0	5.00 (1.34)
BDS[d]	3.0	3.0	2.5	3.5	5.0	2.0	3.12 (1.03)	3.5	3.0	2.0	3.5	2.5	2.0	2.75 (0.69)
Subject Performed Tasks[e]														
Free Recall														
Correct (S)	1	0	0	2	2	2	1.17 (0.98)	0	0	3	0	2	1	1.00 (1.26)
Correct (L)	1	0	0	2	2	2	1.17 (0.98)	0	0	3	0	2	1	1.00 (1.26)

Table 9 continued

Cued Recall

Correct (S)	4	7	0	1	6	2	3.33 (2.80)	2	1	5	4	3	4	3.17 (1.47)
Correct (L)	8	7	5	6	6	3	5.83 (1.72)	7	7	5	6	4	7	6.00 (1.26)

[a]Mini-Mental State Exam (MMSE, Folstein, Folstein, & McHugh, 1975).
[b]Geriatric Depression Scale (GDS, Sheikh & Yesavage, 1986).
[c]Vocabulary Score, Short-Form of the WAIS Vocabulary test (Jastak & Jastak, 1965).
[d]Forward Digit Span (FDS) and Backward Digit Span (BDS) from the Wechsler Adult Intelligence Scale (Wechsler, 1955).
[e]Subject-performed tasks (SPT) (Cherry, Simmons & Camp, 1999).

on measures of secondary memory (Cherry & Plauche, 1996). Memory for the object and action improved when the participants were presented with the object as a cue in the cued recall task. These findings suggest large deficits in secondary memory for the current sample. The improvement of participants in the cued recall task stresses the importance of computing separate scores for free recall and cued recall.

Procedure

Participants were trained to remember a name-face association using the photographic stimuli described in the general method. Six of the participants received adjusted spaced retrieval training and the other six received training on a fixed interval retrieval schedule (described later). The daily procedure was administered as described in the general method (see Table 6).

Practice Trials. At the beginning of session one, all participants performed several practice trials at the 5-second interval until they met the criteria of one correct trial (selected the correct picture and stated the correct name). After examining the session one spaced retrieval data from Hawley and Cherry (2004), we determined it was necessary for each participant to train to one perfect trial rather than set a predetermined number of practice trials, as the archival data revealed many participants took multiple trials to achieve success on the task initially (see Appendix B). We estimated practice trials to number at least six based on session one data from Hawley and Cherry (2004). Practice trials were included in both conditions to ensure that all participants had an understanding of the task requirements before training began.

Training Sessions. For each participant, a total of twelve individual training sessions were conducted on separate days across a 4-week period, as outlined in the general method.

The SR training intervention is described in detail in the general method. The schedule for sessions in the fixed interval retrieval group is described in more detail next.

The training schedule for the fixed interval retrieval group was based on an analysis of archival data from Hawley and Cherry (2004) that used spaced retrieval to train name-face associations. Training data (excluding Hawley & Cherry's S6 who had severe cognitive impairment, MMSE = 5, and was not representative of mild to moderate dementia) was examined to estimate the total number of trials per session and determine the fixed interval for each session. Table 10 contains the training schedule, by session, with number of trials and length of interval for the non-expanding group. The number of trials per session was determined empirically by taking the mean number of trials from the corresponding session in the SR archival data. The mean number of trials from session one in the archival data, 36, was used as the beginning number of trials in session one in this study. On average, the mean number of trials per session dropped by approximately three trials across sessions, consequently, the number of trials in each of the following sessions was then decreased by three (see Table 10). All participants, regardless of group, followed the total trials per session outlined in Table 10. The nature of SR involves trial intervals to be increased based on performance. In the event a participant achieved large time intervals, training was stopped at an upper limit of 1.5 hours.

The fixed time interval per session was also determined empirically, based on Hawley and Cherry's data (see Appendix B). To determine the fixed time interval per session, the mean longest duration per session in the SR data was examined. Participants

Table 10: Fixed Interval Retrieval Training Schedule by Session

Session	Total Trials	Time Interval (in seconds)
1	36	10
2	33	25
3	30	40
4	27	55
5	24	70
6	21	85
7	18	100
8	15	115
9	12	130

improved an average of 53 seconds per session in longest duration. The mean longest duration in session one of the spaced retrieval group was 70 seconds. The interval for session one in the control group was initially set at slightly less than half this longest duration to 30 seconds. However, to ensure the task was not too difficult and comparable to the SR group, the first fixed interval was set at the equivalent initial interval the SR group received, 10 seconds. From this beginning interval, the fixed interval is increased by 15 seconds in each subsequent session (see Table 10). Fifteen seconds is approximately one fourth of the average improvement in longest duration per session by Hawley and Cherry's group. This proportional increase in the average improvement is an attempt to account for

the gradual learning involved in the spaced retrieval task, reflected in the archival data. This training schedule is based on the assumption that learning from session to session is linear. Pilot work was conducted with two additional subjects; these two subjects were not included in the twelve participants proposed for this experiment. Pilot subjects were trained using the fixed interval schedule outlined above to determine if the proposed spacing was at an appropriate level for comparison to the SR group. Table 11 contains the pilot subjects training performance by session. Pilot 1 performed well throughout the first two weeks of training decreasing in the number of failed trails and improving in proportion correct from week 1 to week 2 (see Table 11). In week three, specifically in the last two sessions, her performance declined. Pilot 2 only participated in training for two weeks. He performed well throughout both weeks of training, with a low number of failed trials and maintaining a proportion correct in the eighties. The results of these two pilot subjects suggest that the fixed interval scheduled has been set at a place where participants could learn and have success on the name-face task. The proposed fixed interval schedule was therefore considered to be at an appropriate level for comparison to a spaced retrieval training program and was implemented in the present research.

Results

Baseline Measures of Memory: Prospective Nametag Task. The results for the prospective nametag task appear in Table 12. For each participant, a total score was calculated by summing the nametag task score from each of the twelve sessions. The highest possible score was 48 points. The results for each participant are as follows: S1 = 5 points, S2 = 16 points, S3 = 4 points, S4 = 23 points, S5 = 4 points, S6 = 15 points, S7 = 4 points, S8 = 9 points, S9 = 10 points, S10 = 0 points, S11 = 2 points, S12 = 2 points.

Table 11: Pilot Data for Fixed Interval Retrieval Training Sessions

	Pilot 1			Pilot 2		
Week One of Training	Session 1 (10sec.)	Session 2 (25 sec.)	Session 3	Session 1 (10sec.)	Session 2 (25 sec.)	Session 3
Failed Trials	15	8	**Holiday**	7	3	**Holiday**
Correct Trials	21	25		29	30	
Proportion Correct	0.58	0.76		0.81	0.91	
Week Two of Training	Session 4 (40 sec.)	Session 5 (55 sec.)	Session 6 (70sec.)	Session 4 (40 sec.)	Session 5 (55 sec.)	Session 6 (70sec.)
Failed Trials	7	5	5	5	3	4
Correct Trials	23	22	19	25	24	20
Proportion Correct	0.77	0.81	0.79	0.83	0.89	0.83
Week Three of Training	Session 7 (85 sec.)	Session 8 (100 sec.)	Session 9 (115 sec.)			
Failed Trials	5	11	13			
Correct Trials	16	7	2			
Proportion Correct	0.76	0.39	0.13			

Participants did not initially remember to turn in their nametags when cued to do so (see Days 1-2). Half of the participants remembered to turn in their nametag during Days 3-5 (S1, S2, S3, S4, S6, S8). In general, most did not remember to turn in their nametags until several cues had been given. S2 and S4 are the exceptions as they remembered to turn in their nametag in on Days 9-11 with few cues offered. Overall, there is only slight improvement in scores for most participants. The results of the prospective nametag task

provide evidence that repetition alone, even after twelve sessions, is not enough to produce a sizeable memorial benefit for memory in impaired older adults.

Shirt color naming task. Participants received a score of zero if they could not remember the color of shirt the experimenter was wearing in the previous session and a score of 1 was awarded if the participant correctly remembered the shirt color. The participants scores were totaled across sessions out of a maximum score of 11. The scores are as follows: S1= 2, S2 = 1, S3 = 0, S4 =2, S5 =1, S6 = 0, S7 = 16, S8 = 1, S9 = 1, S10 = 0, S11 = 0, S12= 0. Seven of the twelve participants remembered the correct shirt color of the experimenter from the previous session on at least one day. S7 remembered on 3 days; S1 and S4 each remembered on 2 days; S2, S5, S8, and S9 each remembered in one session. After eleven days of exposure to the shirt color task only one participant, S8, was able to recall the correct color of shirt from the previous session on the final day of testing. Overall, participants performed very poorly on this task, despite repeated exposure. This finding is consistent with secondary memory deficits observed in the SPT (see Table 8). The results of the shirt color task provide additional evidence that repetition alone is not sufficient to provide memorial benefits with memory impaired older adults.

Training Trials

General Impressions of Performance. Table 13 contains each participant's weekly proportion correct by training group. For each participant, separate proportion scores were calculated by dividing the number of correct trials by the number of total trials, collapsing over the three sessions within each week. Overall, the effect of adjusted spaced retrieval training is much more consistent in comparison to the fixed interval retrieval training on recall of the correct name-face association. To be precise, all six of the adjusted spaced

Table 12: Summary of Nametag Task

	Adjusted Spaced Retrieval						Fixed Interval Retrieval					
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Days 1-2 total	0	0	0	1	0	2	1	0	0	0	1	0
Days 3-5 total	2	3	1	4	0	2	0	2	0	0	0	0
Days 6-8 total	2	3	1	6	3	2*	10[1]	2	2	0	0	0
Days 9-11 total	1	10	2	9	0	5	4	4	6	0	0	1
Day 12	0	0	0	3	1	2	1	1	2	0	1	1
Total	5	16	4	23	4	15	16	9	10	0	2	2

Note. Total is based on a maximum score possible of 48. *indicates missing one data for one day.

retrieval participants increased their proportion correct scores from week 1 to week 3. The fixed interval retrieval participant's outcomes were much more mixed, with two participants (S9, S12) increasing in their proportion correct from week 1 to week 3, while the remaining participants (S7, S8, S10, S11) decreased in their proportion correct from week 1 to week 3. In the first week of training (i.e. sessions 1-3), the fixed interval group ($M = 0.61$) outperformed the spaced retrieval group ($M = 0.56$) on the name-face task. In the second week of training (i.e. sessions 4-6), the spaced retrieval group ($M = 0.65$) completed the name face task more accurately than did the fixed interval group ($M = 0.49$). The second week of training showed variability in the fixed interval retrieval group. Two participants (S9, S12) continued to show an increase in their proportion scores over the second week.

[1] Participant was awarded 4 points on days 7, 8, 11 of training due to handing experimenter name tag at the end of training trials rather than waiting for the prompt, 'we are finished for the day'.

However, the remaining subjects (S7, S8, S10, S11) all dropped in their proportion correct scores from week 1 in comparison to week 2. S7 and S10 showed a moderate drop while S8 and S11 showed a more substantial decline. In comparison, all members of the adjusted spaced retrieval group improved in their proportion correct scores from week 1 to week 2. The third week of training (i.e sessions 7-9), showed the spaced retrieval participants (M = 0.81) performing consistently better on the name-face task in comparison to their fixed interval counterparts (M = 0.55). The fixed interval retrieval group continued to show variability in the third week of training. Two participants (S9, S12) increased their proportion correct from week 2 to week 3. S10 and S11 also improved slightly from week 2 to week 3 however this improvement did not reach the initial proportion correct observed in week 1. The remaining two participants (S7, S8) decreased in proportion correct from week 2 to week 3, with S8 performance particularly reduced. In comparison, all of the adjusted spaced retrieval participants improved in their proportion correct from week 2 to week 3, providing a more consistent learning pattern of the name-face association. *T*- tests for independent samples were run to evaluate group differences in weekly proportion correct for all three weeks of training. No significant effects occurred in these analyses.

Adjusted Spaced Retrieval Group Detailed Training Performance Analysis. In week 1 the adjusted spaced retrieval group's weekly proportion correct ranged from 0.45-0.78 (see Table 13). In week 2 each participant's proportion correct increased with scores ranging from 0.53 - 0.98. By week 3, every participant in this group continued to increase their proportion correct with week 3 scores higher than those from week 1. Week 3 proportion scores ranged from 0.67- 1.00. For example, S2 went from a score of 0.52 in week 1, to 0.57 in week 2 and then improved to 0.73 in week 3. S4 scored 0.78 in week 1

and then increased to 0.98 in week 2. By week 3, S4 was performing at 1.00 proportion correct[2]. S6 also showed proportion correct increases from week 1, to week 2, and week 3, with scores of 0.49, 0.58, 0.80, respectively[3]. Although the magnitude of the gains each week of training differed by participant, all participants showed greater accuracy in selecting the correct picture and stating the target's name over the three weeks of training. Adjusted spaced retrieval training revealed a consistent performance profile for all members in the group.

Fixed Interval Retrieval Group Detailed Training Performance Analysis. In week 1 the fixed interval retrieval group's weekly proportion correct ranged from 0.37- 0.85 (see Table13). The fixed interval group outperformed the spaced retrieval group in week 1. By week 2, the fixed interval group's performance is declining overall, with scores ranging from 0.18 - 0.90. By week 3, the group continued to decline with scores ranging from 0.07 - 1.00. The performance of this group was very mixed. Only two participants (S9, S12) increased in their proportion correct scores over the three weeks of training. For example, subject 9 performed particularly well with scores of 0.85, 0.90, and 1.00 in weeks 1, 2 and 3. The remaining four participants (S7, S8, S10, S11) all decreased in their proportion correct from week 1 to week 3. Two participants (S10, S11) decreased in their performance from week 2 in comparison to week 1 and then had an increase in performance in week 3, however their scores in week 3 did not surpass their scores after the first week of training.

[2] S4 performed well beginning in session 2. She achieved an 18 min. time interval and training was discontinued when training reached 1.5 hours. As a result, S4 received a fewer number of total trials in sessions 2-7 than other participants.
[3] S6 did not receive training in session 5.

Table 13: Training Performance Results by Weekly Proportion Correct

	Week 1		Week 2		Week 3	
Participants Adjusted Spaced Retrieval	*M*	*SD*	*M*	*SD*	*M*	*SD*
S1	0.45	(.09)	0.54	(.06)	0.67	(.11)
S2	0.52	(.03)	0.57	(.12)	0.73	(.06)
S3	0.63	(.01)	0.67	(.04)	0.84	(.02)
S4	0.78	(.26)	0.98	(.03)	1.00	(.00)
S5	0.49	(.04)	0.53	(.08)	0.82	(.11)
S6	0.49	(.05)	0.58	(.04)	0.80	(.17)
Mean	**0.56**	**(.12)**	**0.65**	**(.17)**	**0.81**	**(.11)**
Fixed Interval Retrieval						
S7	0.73	(.10)	0.63	(.07)	0.60	(.19)
S8	0.54	(.26)	0.18	(.11)	0.07	(.12)
S9	0.85	(.08)	0.90	(.08)	1.00	(.00)
S10	0.37	(.08)	0.21	(.15)	0.31	(.09)
S11	0.41	(.18)	0.18	(.16)	0.36	(.05)
S12	0.76	(.16)	0.86	(.05)	0.93	(.01)
Mean	**0.61**	**(.20)**	**0.49**	**(.35)**	**0.55**	**(.37)**

The remaining two participants (S7, S8) both decreased in proportion correct over all three weeks of training, with S7 making a notable decline going from a proportion correct of 0.54in week 1, to 0.18 in week 2 and then really falling off in week 3 with only 0.07

proportion correct. In general, most of the fixed interval group did not improve in their learning of the name-face association over the three weeks of training with the exceptions of S9 and S12.

Table 14 presents the number of failed and passed trials by session and group. A series of *t*-tests on independent samples was run to determine if group performance differed by session. Tests were run on the proportion correct for each session by group, to control for differences in number of total trials. Proportion correct was calculated for each group by dividing the total number of passed trials in each group and dividing by the total number of trials per group. The analysis revealed no significant effects between the groups on individual session performance. One comparison was marginally significant. In session 8, the SR group performed better on the name-face task than the FI group, $t(10) = 1.96$, $p = .08$.

Live Person Transfer Task

Tables 15a and 15b contain each participant's performance on the live person transfer task by group. In general, most participants in both groups recognized the target picture during week 1 even though they did not know her name (except for S2 who failed all transfer tasks in week 1, and S4, who recognized her and knew her name). By week 3, half of the spaced retrieval participants (S2, S4, S5) were able to call the target by name when asked by the experimenter (Recall 2). Two participants (S1, S6) were able to call the target by name (Recognition Name) after correctly selecting her picture from the board (Recognition Face) and the last participant (S3) was able to call the target by name (Recognition Name) after being handed the target picture. In contrast, by week 3 only one fixed interval retrieval participant (S9) called the live person target by name when asked by

the experimenter (Recall 2). In addition, only two other fixed interval retrieval participants (S10, S12) were able to call her by name (Recognition Name) after selecting her picture from the board (Recognition Face). The remaining three fixed interval retrieval participants (S7, S8, S11) were only able to correctly select the target's picture from the board (Recognition Face) but could not call her by name (Recognition Name). At the 72-hour delay transfer task, one adjusted spaced retrieval participant (S4) spontaneously called the target by name (Recall 1), while two additional participants (S5, S6) called the live target by name when asked by the experimenter (Recall 2). The remaining three adjusted spaced retrieval participants (S1, S2, S3) could not call the target by name (see Recognition Name). At the 72-hour delay only one fixed interval retrieval participant (S9) was able to call the target by name when asked by the experimenter (Recall 2) and one additional participant (S10) was able to call the target by name after selecting her picture from the board (Recognition Name and Face). The remaining fixed interval retrieval participants (S7, S8, S11, S12) could not call the target by name. A more detailed analysis of each group's performance follows.

Adjusted Spaced Retrieval Group Detailed Transfer Task Analysis. In week 1 of the live person transfer task no participants were able to successfully pass Recall Task 1 or Recall Task 2 (see Table 15a). Two participants (S4, S6) were able to call the target by name after they correctly selected her picture from the board. Three participants (S1, S3, S5) were able to correctly select the target's picture from the board but could not call her by name. One participant (S2) did not have success on any of the Recall or Recognition tasks
By week 2, S4 was able to call the target by name when asked by the experimenter (Recall Task 2), improving from week 1 of only being able to call the target by name after selecting

Table 14: Number of Failed and Passed Trials by Session and Group

Session 1				Session 2			
	Pass	Fail	Total		Pass	Fail	Total
SR	112	104	216	SR	103	80	183
FI	140	76	216	FI	112	85	197
	252	180	432		215	165	280

Session 3				Session 4			
	Pass	Fail	Total		Pass	Fail	Total
SR	97	71	168	SR	92	61	153
FI	110	70	180	FI	88	74	162
	207	141	348		180	135	315

Session 5				Session 6			
	Pass	Fail	Total		Pass	Fail	Total
SR*	72	42	114	SR	81	40	121
FI	60	84	144	FI	65	61	126
	100	126	226		146	101	247

Session 7				Session 8			
	Pass	Fail	Total		Pass	Fail	Total
SR	82	26	106	SR	76	14	90
FI	59	49	108	FI	49	41	90
	139	75	214		125	55	180

Session 9			
	Pass	Fail	Total
SR	61	11	72
FI	39	33	72
	100	44	144

Note. * indicates missing data for S6 during this session.

her picture from the board. In addition, three participants (S1, S5, S6) were able to correctly select the target's picture from the board and called her by name in week 2. In week 1, only S6 had been able to successfully complete this task, whereas S1 and S5 could only select the target's picture from the board (Recognition Face) but not call her by name (Recognition Name). One participant (S2) improved from not being able to complete any of these tasks

Table 15a: Transfer Task Performance for SR Participants

		Recall 1	Recall 2	Recognition Face	Recognition Name
S1	Week 1	0	0	1	0
	Week 2	0	0	1	1
	Week 3	0	0	1	1
	72 hr. delay	0	0	0	0
S2	Week 1	0	0	0	0
	Week 2	0	0	0	1
	Week 3	0	1	-	-
	72 hr. delay	0	0	1	0
S3	Week 1	0	0	1	0
	Week 2	0	0	1	0
	Week 3	0	0	0	1
	72 hr. delay	0	0	1	0
S4	Week 1	0	0	1	1
	Week 2	0	1	-	-
	Week 3	0	1	-	-
	72 hr. delay	1	-	-	-
S5	Week 1	0	0	1	0
	Week 2	0	0	1	1
	Week 3	0	1	-	-
	72 hr. delay	0	1	-	-
S6	Week 1	0	0	1	1
	Week 2	0	0	1	1
	Week 3	0	0	1	1
	72 hr. delay	0	1	-	-

Note. 0 = failed to recall or recognize and 1 = passed task. Recall 1 = spontaneously stating Target's name; Recall 2 = experimenter asks, 'Do you know my friend?'; Recognition Face = selecting Target picture from the board; Recognition Name = stating Target's name after looking at the picture.

successfully in week 1 to being able to call the target by name after being handed the picture (Recognition Name). The remaining participant (S3) continued to be able to correctly select

Table 15b: Transfer Task Performance for F I Participants

		Recall 1	Recall 2	Recognition Face	Recognition Name
S7	Week 1	0	0	1	0
	Week 2	0	0	1	0
	Week 3	0	0	1	0
	72 hr. delay	0	0	1	0
S8	Week 1	0	0	1	0
	Week 2	0	0	1	0
	Week 3	0	0	1	0
	72 hr. delay	0	0	1	0
S9	Week 1	0	0	0	1
	Week 2	0	1	-	-
	Week 3	0	1	-	-
	72 hr. delay	0	1	-	-
S10	Week 1	0	0	1	0
	Week 2	0	0	1	1
	Week 3	0	0	1	1
	72 hr. delay	0	0	1	1
S11	Week 1	0	0	0	0
	Week 2	0	0	0	0
	Week 3	0	0	1	0
	72 hr. delay	0	0	1	0
S12	Week 1	0	0	1	0
	Week 2	0	0	1	1
	Week 3	0	0	1	1
	72 hr. delay	0	0	1	0

Note. 0 = failed to recall or recognize, 1 = passed task, and (-) indicates task was not administered due to success on the previous recall or recognition task. Recall 1 = spontaneously stating Target's name; Recall 2 = experimenter asks, 'Do you know my friend?'; Recognition Face = selecting Target picture from the board; Recognition Name = stating Target's name after looking at the picture.

the target's picture from the board (Recognition Face) but is unable to call her by name (Recognition Name).

After 3 weeks of training, three adjusted spaced retrieval participants (S2, S4, S5) were able to call the live person target by name when asked by the experimenter (see Table 15a). This is particularly impressive for S2 who improved dramatically on this task from week 2 where he was only able to call the target by name after being handed the picture (Recognition Name). Two participants (S1, S6) continued to call the live target by name after correctly selecting her picture from the board (Recognition Name and Face). The final participant (S3) was able to call the live target by the correct name after being handed the picture (Recognition Name) whereas in week 2 she could only select the target's picture (Recognition Face) but could not call her by name.

At the 72-hour delay transfer task three adjusted spaced retrieval participants (S4, S5, S6) were able to successfully complete one of the Recall Tasks; S4 spontaneously called the target by name (Recall Task 1) and S5 and S6 called the target by name when asked by the experimenter (Recall Task 2). Two participants (S2, S3) were able to correctly select the target's picture from the board (Recognition Face) and one participant (S1) was unsuccessful on all of the live transfer tasks.

Overall, the adjusted spaced retrieval group had great success on the transfer tasks. The results demonstrated that spaced retrieval is a viable option for training a name-face association and transferring that association to a live person. All of the participants in the adjusted spaced retrieval group were able to call the live target by name at some point during the live person transfer tasks. Four of the six participants were able to call the live target by name when asked by the experimenter and three of these six participants were able to call the experimenter by name after a 72 hour delay (see Table 15a).

Fixed Interval Retrieval Group Detailed Transfer Task Analysis. In week 1 of the live person transfer task no fixed interval retrieval participants were able to successfully pass Recall Task 1 or Recall Task 2 (see Table 15b). Four of the participants (S7, S8, S10, S12) were able to select the target's name from the board (Recognition Face) but could not call her by name (Recognition Name). Only one participant (S9) was able to call the live target by name after being handed the picture from the board (Recognition Name). The remaining participant (S11) was unable to pass any of the live person transfer tasks.

By week 2, S9 improved to being able to call the target by name when asked by the experimenter (Recall Task 2). Two additional participants (S10, S12) also showed improvement in week 2. Both participants were now able to select the target's picture from the board (Recognition Face) and also call her by name (Recognition Name). The remaining three participants (S7, S8, S11) did not improve on the transfer task in week 2. Two participants (S7, S8) continued to be able to select the target's picture from the board (Recognition Face) but could not call her by name (Recognition Name). S11 continued to fail on all of the live person transfer tasks.

After 3 weeks of training the fixed interval retrieval group's performance on the live person transfer task remained the same as in week 2, except for one participant (S11) who did not show improvement on the task. Participant 11 was unsuccessful for two weeks on any of the transfer tasks but in week 3 was able to select the target's picture from the board (Recognition Face) but still could not call her by name (Recognition Name).

At the 72-hour delay transfer task only one participant (S9) was able to call the live target by name when asked by the experimenter. One participant (S10) was able to select the target's picture from the board (Recognition Face) and then call the target by the correct

name (Recognition Name). The remaining four participants (S7, S8, S11, S12) sucessfully selected the target's picture from the board (Recognition Face) but could not call the live target by name (Recognition Name).

Overall, the fixed interval retrieval group did very poorly on the live person transfer task. Only one participant (S9) was ever able to call the target by name when asked by the experimenter. Only two additional participants (S10, S12) were ever able to select the target's picture and call her by the correct name. The remaining participants (S7, S8, S11) never called the live target by her name (see Table 15b).

Table 16 lists the number of passed and failed recalls at transfer task by group. A passed recall was awarded if the participant spontaneously recalled the target (Recall 1) or recalled the target when asked by the experimenter (Recall 2). A Cochran test, which evaluates differences among related proportions, was run on each group's performance on recall across transfer tasks. There were no significant differences among performance across the four transfer tasks for either group (SR group $Q = 6.23$, $p = .10$, FI group $Q = 3.00$, $p = .39$).

Table 16: Transfer Task Recall Performance by Group

	Week 1		
	Pass	Fail	Total
SR	0	6	6
FI	0	6	6
	0	12	12

	Week 2		
	Pass	Fail	Total
SR	1	5	6
FI	1	5	6
	2	10	12

	Week 3		
	Pass	Fail	Total
SR	3	3	6
FI	1	5	6
	4	8	12

	72 hour delay		
	Pass	Fail	Total
SR	3	3	6
FI	1	5	6
	4	8	12

Note. A pass indicates the participant called the target by name spontaneously (Recall 1) or when asked by the experimenter (Recall 2).

Explicit Memory for the Target Person

Immediate Recall/Recognition: Week 1: At the end of each training session participants were asked to free recall, or recognize if they were unable to recall, the target person. Tables 17a and 17b show the results for each participant by group. During the first week of training, five of the six adjusted spaced retrieval participants were able to free recall the target person (see Table 17a). Two participants (S1, S6) were able to free recall the target one time during the first week, while two additional participants (S2, S3) were able to free recall her by name on two separate days. S4 consistently free recalled the target on all three days of week one training. The fixed interval retrieval group had three participants that were able to free recall the target during the first week of training (see Table 17b). Two participants (S10, S12) were able to recall her by name once during the first week and one participant (S9) was able to free recall the target on two days during the first week. The finding that most participants were never able to consistently recall the trained target person only moments after the completion of the session is noteworthy. This finding is especially interesting in that the participants had been trained with the target on as many as 36 trials. In addition, the fixed interval groups trials during this week were set at 10 s, 25 s, and 40s. This finding is consistent with the secondary memory impairment often found in older adults with probable AD.

When participants were unable to free recall the target, all nine pictures were presented again for the recognition task. Participants were quite successful at picking out the target from the other eight pictures. For the adjusted spaced retrieval group, there were only three sessions where participants were not able to at least recognize the target's picture; S3 in session 1, S5 is session 3 and S6 in session 1. The fixed interval retrieval group had only

Table 17a: Summary of Immediate Recall and Recognition Task for Adjusted Spaced Retrieval Group

		Participants					
Measure		S1	S2	S3	S4	S5	S6
Recall / Recog.Face / Recog.Name							
Week 1	Session 1	0/1/0	0/1/0	0/0/0	1/-/-	0/1/0	0/0/0
	Session 2	1/-/-	1/-/-	1/-/-	1/-/-	0/1/0	1/-/-
	Session 3	0/1/1	1/-/-	1/-/-	1/-/-	0/0/0	0/1/0
	Total	1/2/1	2/1/0	2/0/0	3/-/-	0/2/0	1/1/0
Week 2	Session 4	1/-/-	0/1/0	0/1/0	1/-/-	1/-/-	0/1/0
	Session 5	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	*
	Session 6	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	0/1/1
	Total	3/-/-	2/1/0	2/1/0	3/-/-	3/-/-	0/2/1
Week 3	Session 7	1/-/-	0/1/0	1/-/-	1/-/-	1/-/-	1/-/-
	Session 8	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	0/0/0
	Session 9	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-
	Total	3/-/-	2/1/0	3/-/-	3/-/-	3/-/-	2/0/0

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task. * indicates missing data point.

Table 17b: Summary of Immediate Recall and Recognition Task for Fixed Interval Retrieval Group

Measure		Participants S7	S8	S9	S10	S11	S12
Recall / Recognition Face / Recognition Name							
Week 1	Session 1	0/1/1	0/1/0	1/-/-	0/0/0	0/0/0	0/1/1
	Session 2	0/1/0	0/1/0	0/1/0	0/1/0	0/0/0	1/-/-
	Session 3	0/1/0	0/1/0	1/-/-	1/-/-	0/0/0	0/1/0
	Total	0/3/1	0/3/0	2/1/0	1/1/0	0/0/0	1/2/1
Week 2	Session 4	0/1/0	0/0/0	1/-/-	1/-/-	0/1/0	0/1/1
	Session 5	0/0/0	0/1/0	1/-/-	0/0/0	0/1/0	0/1/0
	Session 6	0/1/0	0/1/0	1/-/-	1/-/-	0/1/0	1/1/0
	Total	0/2/0	0/2/0	3/-/-	2/0/0	0/3/0	0/3/1
Week 3	Session 7	0/1/1	0/1/0	1/-/-	1/-/-	0/0/0	1/-/-
	Session 8	0/0/0	0/1/0	1/-/-	0/1/1	0/0/1	1/-/-
	Session 9	0/1/0	0/1/0	1/-/-	1/-/-	0/0/0	1/-/-
	Total	0/2/1	0/3/0	3/-/-	2/1/1	0/0/1	3/-/-

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task.

two participants (S10, S11) that could not at least recognize the target's picture. S10 in Session 1 and S11 was unsuccessful throughout the week. The fact that most participants were able to recognize the target, the majority of the time, suggests that they all hadknowledge of the target person but may have been unable to access that knowledge

during the free recall task. The re-presentation of the stimulus was enough to prompt successful recognition of the target. These findings are consistent with the results of the SPT data, where participants did more poorly on free recall in comparison with cued recall (see Table 8).

Week 2: In week 2 the majority of the adjusted spaced retrieval group was consistently able to free recall the target immediately after the training sessions. Half of the participants in the adjusted spaced retrieval group (S1, S4, S5) were able to free recall at every session, while S2 and S3 were able to free recall at two of the three sessions. The fixed interval retrieval group did not perform as well on the free recall task in comparison to the adjusted spaced retrieval group. One participant (S9) consistently free recalled the target over all three sessions in week 2. Another participant (S10) free recalled the target in two of the three sessions this week. These findings from the week 2 free recall data are interesting in that only the adjusted spaced retrieval group appeared to consistently maintain the name-face association. The fixed interval retrieval group has only 2 participants that showed any type of consistent recall of the name-face association. After two weeks of training it appeared spaced retrieval may provide more consistent recall of the target person.

The recognition task in week 2 continued to show participants performing well. The spaced retrieval participants performed well on recognition when the target was not free recalled. In the sessions where the target was not free recalled, the target's picture was recognized; S2, S3 and S6 in session 4. In addition, S6 recognized the picture and stated the target's name is session six. The fixed interval retrieval group also performed well on the recognition task. Two participants (S11, S12) were able to recognize the target picture consistently over all three sessions in week 2. S12 was also able to state the target's name

after selecting the photograph in session 4. Two additional participants (S7, S8) were able to recognize the target's picture in two of the three sessions this week. There were three instances where members of the fixed interval retrieval group could not recall or recognize the target immediately following training; S8 in session 4 and S7 and S10 in session 5. The results of the recognition task in week 2 showed the fixed interval retrieval group performed less well than the spaced retrieval group. Specifically, there are three instances when even representation of the stimuli did not aid fixed interval retrieval participants in recall or recognition. These findings indicate learning of the name-face association may not be as strong in the fixed interval retrieval group.

Week 3: In week three all members of the adjusted spaced retrieval group were able to free recall the target. Four participants (S1, S3, S4, S5) were able to consistently recall the targets name over all sessions in week 3. S2 and S6 each free recalled the target on two of the three sessions. The fixed interval retrieval group performed less well on this task. Two of the participants (S9, S12) were able to consistently free recall the target each day of this week. One additional participant (S10) was able to free recall the participant on two of three days during this week. The week 3 results continue to highlight the differences in immediate recall of the name-face association between the two groups. The adjusted spaced retrieval group consistently recalled the target where only half of the fixed interval retrieval participants showed any consistency on the task.

Recognition continued to be high for both groups, with the spaced retrieval group only reported one session where recognition was unsuccessful (S6 in session 8). The fixed interval retrieval group continued to be able to recognize the target picture even though they did not know her name. Only two participants (S7 and S11) had sessions where they could

not successfully recognize the target; S7 is session 8 and S11 in session 7 and session 9. The results of the last week of training recognition task continued to show differences between the two groups. The fixed interval retrieval group appeared to have knowledge of the target, however, they continued to be unable to access that knowledge during the free recall task. These findings add support that spaced retrieval may be superior to a fixed interval training schedule in facilitating free recall of the target.

Participant scores on immediate recall of the target were evaluated by group to determine performance differences across three weeks of training. A passed recall was awarded if the participant spontaneously recalled the target when asked by the experimenter to recall the photograph that had just been used during training. A *t*-test on independent samples was performed to determine if differences in group performance by week of training. The analysis revealed no significant effects between the groups on weekly immediate recall performance. One comparison was marginally significant. In week 3, the SR group (M = 2.67, SD = .52) performed better on the immediate free recall task in comparison to the FI group (M = 1.33, SD = 1.51), $t(10) = 2.05$, p =. 07.

Delayed Recall. Each participant's performance by group on the delayed recall task can be found in Tables 18a and 18b. The majority of the adjusted spaced retrieval participants (S1, S3, S4, S5) successfully recalled the target by week three of training; specifically S4 in week 1, S1 and S5 in week 2 and S3 in week 3 (see Table 18a). Only S2 and S6 were never able to free recall the target. However, they were able to recognize the target's picture from the distrators. There was only one session where a spaced retrieval participant (S6 in session 1) was unable to at least recognize the target picture at Delayed Recall. In contrast, the fixed interval retrieval group performed poorly on this task (see Table 18b). Only two participants

Table 18a: Summary of Delayed Recall Task for Adjusted Spaced Retrieval Group

		Participants					
Measure		S1	S2	S3	S4	S5	S6
Recall / Recog. Face / Recog. Name							
Week 1	Session 1	0/1/0	0/1/0	0/1/0	1/-/-	0/1/0	0/0/0
	Session 2	0/1/0	0/1/0	0/1/1	1/-/-	0/1/1	0/1/0
	Total	0/2/0	0/2/0	0/2/1	2/-/-	0/2/1	0/1/0
Week 2	Session 4	0/1/0	0/1/0	0/1/0	1/-/-	1/-/-	*
	Session 5	1/-/-	0/1/0	0/1/0	1/-/-	1/-/-	0/1/0
	Total	1/1/0	0/2/0	0/2/0	2/-/-	2/-/-	0/1/0
Week 3	Session 7	0/1/0	0/1/0	1/-/-	1/-/-	1/-/-	0/1/1
	Session 8	1/-/-	0/1/0	0/1/0	1/-/-	1/-/-	0/1/0
	Total	1/1/0	0/2/0	1/1/0	2/-/-	2/-/-	0/2/1

Table 18b: Summary of Delayed Recall Task for Fixed Interval Retrieval Group

		Participants					
Measure		S7	S8	S9	S10	S11	S12
Recall / Recog. Face / Recog. Name							
Week 1	Session 1	0/1/0	0/1/0	0/0/0	0/0/0	0/0/0	0/1/0
	Session 2	0/1/0	0/0/0	0/1/0	0/0/0	0/0/0	0/1/0
	Total	0/2/0	0/1/0	0/1/0	0/0/0	0/0/0	0/2/0
Week 2	Session 4	0/0/0	0/1/0	0/1/0	0/0/0	0/0/0	0/1/0
	Session 5	0/0/0	0/1/0	1/-/-	0/1/0	0/0/0	1/-/-
	Total	0/0/0	0/2/0	1/1/0	0/1/0	0/0/0	1/1/0

Table 18b continued

Week 3	Session 7	0/1/0	0/0/0	1/-/-	0/0/0	0/1/0	1/-/-
	Session 8	0/1/0	0/0/0	0/1/0	0/0/0	0/1/0	0/1/1
	Total	0/2/0	0/0/0	1/1/0	0/0/0	0/2/0	1/1/1

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person. * indicates missing data point.

(S9, S12) in the fixed interval retrieval group were ever able to free recall the target (both participants' free recalled in sessions 5 and 7). The other participants (S7, S8, S10, S11) ailed to successfully recall the target in the delayed recall task even after three weeks of training. Although most participants were able to recognize the target picture in at least half of the sessions (S7, S8, S9, S12), there were several sessions where recognition of the target was never achieved. For example, S11 had only 2 sessions where he recognized the target picture (sessions 7 and 8) and S10 had only one day when she successfully recognized the target (session 5). These results are similar to the findings of the immediate recall task in that participants during the first week of training were unable to remember the target when tested only with free recall. These findings from the first week replicate the results of the delayed recall task in previous spaced retrieval studies utilizing this same paradigm that had a one week training schedule (see Cherry & Simmons-D'Gerolamo, 1999, Cherry et al., 1999). The findings from the second and third weeks of training are quite interesting in that the adjusted spaced retrieval participants, as a group, were able to free recall the target with some regularity. The fixed interval retrieval group continued to be able to recognize the target but as a group could not free recall the target. These findings lend additional support

that adjusted spaced retrieval training may facilitate more consistent learning of the name-face target in comparison to the fixed interval retrieval schedule.

Participant's scores on delayed free recall of the target were evaluated by group to determine performance differences across weeks of training. A passed recall was awarded if the participant spontaneously recalled the target when asked by the experimenter to recall the photograph used during the prior training session. A *t*-test on independent samples was performed to determine if group performance differed by week. The analysis revealed no significant effects between the groups on performance.

Final Recall/Recognition. Tables 19a and 19b contain participants' scores on the final delayed recall task. Again, the adjusted spaced retrieval group outperformed their fixed interval retrieval counterparts. Five of the six adjusted spaced retrieval participants (S1, S3, S4, S5, S6) free recalled the target by the third week of training. In addition, two of the participants (S4, S5) consistently recalled the target at each of the final recall tasks. S1 was able to recall the target on two of the three tasks, whereas S3 and S6 were able to recall the target after three weeks of training. In contrast, only one fixed interval retrieval participant (S9) was able to free recall the target and that only happened in the delayed recall following three weeks of training (see Table 19b). All other adjusted spaced retrieval participants recognized the target when presented with the other eight pictures. However, two fixed interval retrieval participants (S10, S11) failed to even recognize the target at final recall; S10 after weeks 1 and 2, and S11 never had success at any final recall task. These data lend more evidence to the idea that participants trained via adjusted spaced retrieval are superior at recalling and recognizing the name-face association. These findings replicate those of the immediate recall task (see Table 17a and 17b). Adjusted spaced retrieval participants, again,

demonstrated their ability to recall the target person while the fixed interval retrieval group was inconsistent in their free recall of the target.

Participant's scores on the final delayed free recall of the target were evaluated by group to determine performance differences across the three weeks of training. A passed recall was awarded if the participant spontaneously recalled the target when asked by the experimenter to recall the photograph used during the prior week of training. A *t*-test on independent samples was run to determine if group performance differed by task. In week 1, the SR participants ($M = .33$, $SD = .52$) free recalled the target more often than their FI counterparts who were unable to recall the target but the difference was not significant ($p > .05$). In week 2, the SR participants ($M = .50$, $SD = .55$) free recalled the target significantly more often than their FI counterparts who were again unable to free recall the target, $t(10) = 2.24$, $p < .05$. In week 3, the SR participants ($M = .83$, $SD = .41$) outperformed the FI participants ($M = .17$, $SD = .41$) on free recall of the target, $t(10) = 2.83$, $p < .05$.

Final Face Recognition Task

On the last day of the study (day 12), participants were presented with 18 photographs, 9 were the stimuli from the spaced retrieval training and 9 were distractor items. Participants were asked to identify the pictures they had seen before. Table 20 contains the results of performance on this task. Overall, participants were able to correctly identify more stimuli photographs (hits) than falsely identifying new items (false alarms). All twelve participants were able to select the target picture as a photograph they had seen before. The fixed interval retrieval group had more hits in comparison to the adjusted spaced retrieval

Table 19a: Summary of Final Delayed Recall Task for Adjusted Spaced Retrieval Group

		Participants					
Measure		S1	S2	S3	S4	S5	S6
Recall / Recog. Face / Recog. Name							
Week 1	Session 3	0/1/0	0/1/0	0/1/1	1/-/-	1/-/-	0/1/0
Week 2	Session 6	1/-/-	0/1/0	0/1/0	1/-/-	1/-/-	0/1/0
Week 3	Session 9	1/-/-	0/1/0	1/-/-	1/-/-	1/-/-	1/-/-
	Total	2/1/0	0/3/0	1/2/1	3/-/-	3/-/-	1/2/0

Table 19b: Summary of Final Delayed Recall Task for Fixed Interval Retrieval Group

		Participants					
Measure		S7	S8	S9	S10	S11	S12
Recall / Recog. Face / Recog. Name							
Week 1	Session 3	0/1/0	0/1/1	0/1/0	0/0/0	0/0/0	0/1/1
Week 2	Session 6	0/1/0	0/1/0	0/1/0	0/0/0	0/0/0	0/1/0
Week 3	Session 9	0/1/0	0/1/0	1/-/-	0/1/0	0/0/0	0/1/0
	Total	0/3/0	0/3/1	1/2/0	0/1/0	0/0/0	0/3/1

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task.

group, whereas the adjusted spaced retrieval group had slightly fewer false alarms than the fixed interval retrieval group. One interpretation of this finding is that SR participants may direct the cognitive resources they have on remembering the trained item and thereby training performance is high, but recognition of all faces was low. In contrast, the FI participants performed better on recognition of all faces, but their training performance was

Table 20a: Summary of Final Face Recognition Task for Adjusted Spaced Retrieval

	Participants						
	S1	S2	S3	S4	S5	S6	Mean
Old Items							
Hits	5	2	6	7	5	6	5.17
Misses	4	7	3	2	4	3	3.83
New Items							
False alarms	0	1	0	0	1	2	0.67
Correct responses	9	8	9	9	8	7	8.33

Table 20b: Summary of Final Face Recognition Task for Fixed Interval Retrieval

	Participants						
	S7	S8	S9	S10	S11	S12	Mean
Old Items							
Hits	7	5	7	8	7	8	7.00
Misses	2	4	2	1	2	1	2.00
New Items							
False alarms	0	2	1	1	1	1	1.00
Correct responses	9	7	8	8	8	8	8.00

Note. Entries are based on a total of 9 facial pictures used in SR training ("old items") and 9 distractor faces ("new items").

lower in comparison to the SR group. These findings imply that there may be a trade off in operation, where the SR participants focus on the target item at the expense of the distractor items. The FI group, who demonstrated poorer memory for the target item, may have processed the entire array of pictures more thoroughly as they were unable to remember which item was the target. In addition, these findings provide evidence that mere exposure

to the photographs during training while not sufficient for maintaining recall and recognition of the items does facilitate some knowledge of the item. Adjusted spaced retrieval training on the item appears necessary for consistent success in recalling or recognizing the item. A *t*-test on independent samples was run on the number of correct responses (hits minus false alarms) to determine if group performance differed on the final face recognition task. The analysis revealed no significant effects between the groups on final face recognition.

Quality of Life

Participant Reports. The dementia quality of life measure (DQoL) was administered to all participants prior to training on the name-face association (session 2) and after training (session 12). Table 20 contains participant results of pre and post training performance on this measure. Overall, adjusted spaced retrieval participants somewhat improved their rankings on all of the quality of life scales at posttest except for the positive affect and humor scales, where they decreased slightly. The fixed interval retrieval participants showed a different pattern in that their rankings on all of the quality of life scales decreased somewhat, except for absence of negative affect, where they reported an increase at posttest compared to pretest. Independent samples *t* tests were run to determine differences between groups at pretest and posttest on the six scales that comprise the DQoL. The adjusted spaced retrieval ($M = 4.29$) group scored higher on the self-esteem scale in comparison to the fixed interval retrieval counterparts ($M = 3.29$), $t\ (11) = 2.34$, $p < 0.05$. No additional significant effects resulted from the analysis. While these trends are admittedly preliminary, they offer some evidence that the success obtained by the spaced retrieval group appears to be is transferring to the patients' feeling somewhat better about themselves, specifically their self-esteem, and their quality of life.

Table 21: Mean Scores on Pre and Post DQoL by Participants

Scales	Groups			
	Spaced Retrieval		Fixed Interval	
	Pre	Post	Pre	Post
-Self Esteem	3.79 (0.66)	4.29 (0.43)	3.67 (0.96)	3.29 (0.95)
Positive Affect / Humor	4.14 (0.74)	4.08 (0.48)	3.51 (0.87)	3.48 (0.68)
Absence of Negative Affect	3.73 (1.12)	3.92 (0.76)	3.38 (0.52)	3.64 (0.49)
Feeling of Belonging	3.56 (0.83)	3.89 (0.78)	3.28 (1.39)	3.22 (1.05)
Sense of Aesthetics	3.01 (0.93)	3.43 (1.35)	3.33 (0.38)	2.97 (1.21)
Overall Quality of Life	3.67 (0.52)	3.67 (1.03)	3.33 (1.03)	3.00 (0.89)

Note. Scores range from 1-5 with higher scores indicating a higher quality of life.

Caregiver Reports. We also administered the DQoL to participant caregivers prior to and after the participants training program for a ranking of what they believed to be the patient's current quality life. Table 22 contains caregiver results of the pre and post training performance on this measure. Overall, adjusted spaced retrieval caregivers showed somewhat higher rankings on all quality of life scales at posttest except for the sense of aesthetics scale, where they decreased slightly. The fixed interval retrieval caregivers showed a more mixed pattern in their rankings on quality of life scales at pretest versus posttest. Three scales increased slightly, positive affect/humor, absence of negative affect and feelings of belonging. Two scales decreased somewhat, self-esteem and sense of aesthetics and the overall ranking of quality of life stayed the same (see Table 21). Paired samples *t* test were used to determine differences between pre and posttest scores offered by

Table 22: Mean Scores on Pre and Post DQoL by Caregivers

Scales	Groups			
	Spaced Retrieval		Fixed Interval	
	Pre[4]	Post	Pre	Post[5]
Self-Esteem	2.70 (1.05)	3.90 (0.76)	3.13 (0.74)	3.00 (1.06)
Positive Affect / Humor	3.27 (0.86)	4.07 (0.67)	3.25 (0.89)	3.50 (0.71)
Absence of Negative Affect	2.86 (0.78)	3.51 (0.67)	3.05 (0.59)	3.14 (0.32)
Feeling of Belonging	1.07 (0.64)	3.67 (0.97)	1.33 (0.30)	1.50 (0.24)
Sense of Aesthetics	3.16 (1.66)	2.96 (1.44)	3.33 (0.85)	2.80 (1.41)
Overall Quality of Life	2.80 (1.10)	3.25 (0.50)	2.50 (1.22)	2.50 (2.12)

Note. Scores range from 1-5 with higher scores indicating a higher quality of life.

caregivers on the six scales that comprise the DQoL. Due to the low number of posttest respondents in the fixed interval retrieval group these analysis were run separately for each group of caregivers. The adjusted spaced retrieval caregivers indicated higher levels of belonging t (4) = -13.36, $p < .01$, absence of negative affect t (4) = -3.23, $p < .05$, and positive affect and humor t (4) = -2.90, $p < .05$ at posttest in comparison to pretest. No significant effects resulted from the analysis on the fixed interval retrieval caregivers. These results provide preliminary evidence that the success obtained by the adjusted spaced retrieval group appears to be transferring to the participants feeling somewhat better about themselves and their quality of life, as perceived by their caregivers. The fixed interval retrieval group caregivers also reported slight improvements in some areas of quality of life.

Due to the low number of caregiver responses at posttest in the fixed interval retrieval group conclusions about caregiver interpretations of the potential benefits to participant quality of life from the fixed interval retrieval training program cannot be offered.

Comparison of Participant and Caregiver Responses on the DQoL. To assess differences between participants and caregivers ratings of participant quality of life we compared all participants, regardless of training group, to all caregivers. An Independent samples *t* test revealed caregivers rated participant's quality of life lower than participants did at pretest on half of the six DQoL scales. Lower rating were reported by caregivers (M = 3.73) in comparison to participants (M = 2.93) on self-esteem $t(21) = 2.30$, $p < .05$, feelings of belonging (caregivers M = 1.21, participants M = 3.42) $t(21) = 2.15$, $p < .01$, and overall quality of life (caregivers M = 2.60, participants M = 3.50), $t(21) = < .04$. The scale absence of negative affect was marginally significant (caregivers M = 2.96, participants M = 0.84), $t(21) = 1.99$, $p = .06$. No other significant effects were observed.

Quality of Participation in Study

On the last day of the program participants were asked about how they liked participating the training program. Table 23 contains participants mean responses to the questions by group and an overall quality of participation in the study score. Inspection of the table reveals most all participants enjoyed participating in the study. The adjusted spaced retrieval group reported slightly higher scores on all questions regarding enjoyment of participating in the training program in comparison to the fixed interval retrieval participants (see Table 23). The exception was the question regarding talking with the

[4] Pre and Posttest DQoL mean scores for the SR group are based on 5 caregiver reports. S6's caregiver did not return the questionnaire at pre or posttest.

experimenter, where the FI group reported a little more enjoyment than the SR group. These findings are similar to the results of the DQoL that found the SR group generally reported slightly higher quality of life rankings than the FI group. The fact that the SR group also reported somewhat higher enjoyment in the training program may indicate performance on the actual name-face task influenced not only feelings about themselves but how much they enjoyed being involved in the study. These patient reports reinforce the simplicity of the name-face task and that participants seem to participate and learn with minimal effort and discomfort.

Table 23: Mean Scores for Quality of Participation in the Study by Group

	Group	
	Spaced Retrieval	Fixed Interval
Getting pulled out of normal activities	3.67 (1.21)	3.00 (0.71)
Learning the name of the person in the picture	3.33 (1.50)	3.17 (1.47)
Selecting the correct picture	4.00 (1.10)	3.40 (1.14)
Talking with me	4.50 (0.55)	4.67 (0.52)
Telling me about yourself	3.83 (1.33)	3.67 (1.03)
Helping me with my school work	4.67 (0.52)	4.33 (1.21)
Overall quality of participation	4.00 (0.59)	3.70 (0.80)

Note. Scores range from 1 – 5 with higher scores indicating a higher enjoyment for participation in the training.

[5]Posttest DQoL mean scores were based on only 2 caregiver responses (S8, S11).

Experiment 1 Discussion

Experiment 1 produced three main findings. First, the results indicate that adjusted spaced retrieval training provided a more consistent performance profile on measures of correct trials, free recall and live person transfer task, in comparison to the fixed interval retrieval training program, indicating that the spacing effect may be contributing to the memory gains observed in the spaced retrieval intervention. Second, the adjusted spaced retrieval group outperformed their fixed interval retrieval counterparts on recall of the name-face association learned during the training sessions, as evidenced by better performance on the live person transfer task (see Table 15a and 15b). The finding of better free recall after training is consistent with the results of Hochhalter et al. (2004) who found adjusted spaced retrieval training to be superior to a uniform training schedule for free recall of a medication (pill) name. Third, findings suggest preliminary evidence that quality of life may be affected by performance on spaced retrieval training.

The finding from Experiment 1 that adjusted SR training leads to a more consistent performance profile and better performance on the transfer task raises the issue of how long these memory gains accrued during training might continue. Experiment 2 was designed to assess the benefits of prior spaced retrieval testing at a 6-month retest and to determine if any potential gains after receiving additional training or booster session during the delay of testing.

EXPERIMENT 2

Participants

A total of six participants with probable AD participated in Experiment 2. They were the same persons in Experiment 1 who received spaced retrieval training (S1, S2, S3, S4, S5, S6). All participants met the exclusion criteria outlined in Experiment 1. For comparison purposes, I will report portions of these six participants original training data from Experiment 1, specifically training performance on sessions one through three. Participants were paired based on similar MMSE scores and randomly assigned to either the booster session group or to the no booster session group. One no booster participant passed away during initial SR training and had to be replaced with a new participant. The original participant had a score of 13 on the MMSE. The replacement participant's MMSE score was higher at 24. As a result, the pairings of the booster group and no booster group on MMSE scores are not ideally matched. Booster session participants received three booster sessions over the 6-month delay of testing. Each booster session consisted of 4 days that included 3 days of SR training (Days 1, 2, 3) and 3 live person transfer tasks (LPT); Day 1 prior to SR training (LPT 1), Day 3 after a week of SR training (LPT 2), and Day 4 at a 72 hour delay (LPT 3).

Individual Difference Measures

The Mini Mental State Exam (MMSE) and the Geriatric Depression Scale (GDS) were completed at the six-month follow up retest to evaluate potential cognitive and affective decline in the participants. Table 24 contains a summary of MMSE and GDS scores at the initial spaced retrieval training sessions and after the 6-month follow up. As a reminder, the

MMSE (Folstein et al., 1975) was used to provide an index of current cognitive status. The maximum score on the MMSE is 30. For the current sample, scores at retest ranged from 16 to 23, confirming cognitive impairment in this sample (see Table 24). Scores remained reasonably stable at the 6-month retest. Two participants (S2, S5) showed a one point decline on this measure at retest. Two participants (S1, S3) demonstrated a two point improvement at retest, whereas S4 demonstrated a one point improvement. S6 score did not change. Moderate change in performance on the MMSE, such as those observed here, are commonly observed in the Alzheimer's population. To obtain a measure of affective status, the GDS (Sheikh & Yesavage, 1986) was also administered at the 6-month retest. Scores at retest on the GDS ranged from 0-6 with a score suggestive of mild depression in S5 only.

Table 24: Summary of Individual Difference Measures at Prior Training and at 6-month Retest

		Measure			
		MMSE[a]		GDS[b]	
		Initial	6-month	Initial	6-month
Booster Group					
	S1	14	16	6	2
	S2	21	20	0	0
	S3	14	16	0	1
No-booster Group					
	S4	22	23	0	0
	S5	24	23	4	6
	S6	18	18	2	0

[a]Mini-Mental State Exam (MMSE, Folstein, Folstein, & McHugh, 1975)
[b]Geriatric Depression Scale (GDS, Sheikh & Yesavage, 1986)

Baseline Measures of Memory

We also administered the two secondary memory measures, the prospective nametag task and the shirt color naming task, across sessions at retest as described in Experiment 1. The prospective nametag task provided a baseline measure of memory for a simple verbal

cue/motor response association without the benefit of spaced retrieval training. Participants are given a series of prompts as reminder to turn in their nametags. The maximum points per day on this task is 4, indicating the participant turned in their nametag upon hearing the cue, 'We are finished for the day' the first time. A score of zero indicate the participant never remembered to turn in their nametag. Points are reduced based on the number of times the prompt is offered. The shirt color task was given as a measure of 48-hour delay recall of single item information without the benefit of spaced retrieval training. The shirt color task is scored as pass or fail, with 1 indicating passed the task and 0 indicating failed the task.

Prospective Nametag Task. The results for the prospective nametag task appear in Table 25. For each participant, a total score was calculated by summing the nametag task score from each of the four retest sessions. The highest possible score was 16 points. The results for each participant are as follows: S1= 0 points, S2 = 5 points, S3 = 2 points, S4 = 6 points, S5 = 0 points, S6 = 2 points. Participants did not consistently remember to turn in their nametags. The two groups are performing comparably on this task with one subject in each group (S2, S4) remembering to turn in their tag after several prompts on multiple days, one participant in each group (S3, S6) remembering to turn in their tag on two different days after several prompts and one participant from each group never remembering to turn in their nametag. Booster session participants received twelve additional exposures to the nametag task as the task was administered on all four days of each of the three booster sessions. It appears the additional twelve sessions of exposure to the nametag task by the booster session group did not improve their performance on this task. The results of the prospective nametag task provide evidence that repetition alone is not enough to produce a sizeable memorial benefit for memory in impaired older adults.

Table 25: Total Correct on Prospective Nametag Task

	Day 1	Day 2	Day 3	Day 4	Total
Booster					
S1	0	0	0	0	0
S2	1	3	1	0	5
S3	0	1	0	1	2
No Booster					
S4	1	2	1	2	6
S5	0	0	0	0	0
S6	0	0	1	1	2

Note. Score is based on a maximum score possible of 16.

Shirt color naming task. Participants received a score of zero if they could not remember the color of shirt the experimenter was wearing in the previous session and a score of 1 was awarded if the participant correctly remembered the shirt color. The participant scores were totaled across sessions out of a maximum score of 3. The scores are as follows: S1 = 1, S2 = 0, S3 = 0, S4 = 1, S5 = 0, S6 = 0. Only one participant in each group ever correctly recalled the color of shirt from the previous session; S1 on day 2 and S4 on day 2. These results continue to highlight the observed deficits in free recall typically observed in persons with Alzheimer's disease.

Procedure

Half of the subjects received additional training or booster sessions and half received no additional training during the 6-month interval between the end of SR training (Experiment

1) and the retest. All participants were retested six months after SR training was initially completed. Retesting was conducted over four sessions that consisted of three SR training periods and three live person transfer tasks. SR training was held on Days 1, 2 and 3. The training sessions lasted for 30 minutes or until the participant expressed fatigue. The first live person transfer task (LPT 1) was used as a measure of memory for the live target after a 6-month delay. The second transfer task (LPT 2) offered a measure of recall and recognition for the target after a week (three sessions) of SR training. The third transfer task (LPT 3) gave a measure of recall and recognition for the live target after a 72-hour delay. Transfer tasks 2 and 3 were administered at the same time intervals as in Experiment 1. The three measures of explicit memory (immediate recall, 48 hour delayed recall and at 72 hour final recall) for the name-face association were administered across the retest sessions as described in the general method. All participants were retested at 6-month delay in the following manner:

Day 1: The nametag task and shirt-color task were given, as described in the general method. Next, the live person transfer task (LPT 1) was administered. The "live" person target entered the room and the participant was asked to recall/recognize the target person. Spaced retrieval trials began again for the same target picture utilized six months prior. Responses were recorded on a prepared sheet.

Day 2: Both the nametag task and the shirt-color task were administered. The instructions for the spaced–retrieval paradigm were given and the training trials followed the procedure described in the general method. Responses were recorded on prepared sheets.

Day 3: The prospective shirt color task and nametag task were given at the beginning of the session. The instructions for the spaced–retrieval paradigm were given and the

training trials began. The posttest nametag task was then administered. Responses were recorded on prepared sheets. The live person transfer task (LPT 2) followed. The "live" person target entered the room and the participant was asked to recall/recognize the target person.

Day 4: The nametag task and shirt color task were administered at the beginning of the session. The final delayed recall task was administered for the target picture. Three individual difference measures were also administered: the MMSE, GDS and the DQoL. The live person transfer task followed. The "live" person target entered the room and the participants were asked to recall/recognize the target person. All responses were recorded.

Booster Sessions. Participants in the booster session condition (S1, S2, S3) received additional training at three predetermined intervals occurring during the 6-month delay of testing. The booster sessions were administered at 1.5 months (6 wks), 3 months (12 wk) and 4.5 months (18 wk) after the initial spaced retrieval training had been completed. Training sessions were conducted over four sessions that consist of three SR training periods and three live person transfer tasks. SR training was administered on Days 1, 2, and 3 of the booster session. SR training lasted for 30 minutes or until the participant expressed fatigue. Live person transfer tasks were administered on Day 1, prior to SR training (LPT 1), on Day 3 after a week of SR training (LPT 2), and on the Day 4 (LPT 3) to offer a measure of recall and recognition at a 72 hour delay. The three measures of explicit memory (immediate recall, 48 hour delayed recall and final recall) for the name-face association were administered across the booster sessions as described in the general method. The procedures for Days 1-4 in the booster sessions were conducted in the same manner as the 6-month delay of testing previously described.

Results

Booster Session Performance. Three participants (S1, S2, S3) received booster sessions as described previously. Table 26 contains participant's performance on spaced retrieval training of the name-face association during each booster session. For each participant, the number of failed trials (FT) reduced from the first session of the booster training (Day 1 Booster 1) to the last day of booster training (Day 3 Booster 3). In addition, all participants increased their longest retention duration (LD) from Day 1 of Booster 1 to Day 3 of Booster 3. All participants also improved in their proportion correct (PC) from the first day of booster training (Day 1 of Booster 1) to the last day of Booster training (Day 3 of Booster 3). As can be seen from Table 26, most participants had some days when their performance fluctuated, but all participants showed performance gains on this task over the three booster sessions.

Transfer Task Performance at Booster Sessions. Each of the participants had three live person transfer tasks per booster session, for a total of nine additional exposures to the live target. Results of the live person transfer task are presented in Table 27. On Day 1, the first live person transfer task (LPT 1) was administered. In each of the three booster sessions, all participants (S1, S2, S3) were able to select the target's picture from the board (Recognition Face). In addition, on LPT 1 in Booster 2, S2 is able to call the target by name (Recognition Name) after selecting the correct picture from the board. This is quite impressive considering the participants have not been exposed to the target or the stimuli in six full weeks. The second transfer task (LPT 2) in the booster was administered on Day 3, after three spaced retrieval training sessions. Two participants (S2, S3) improved to being able to not only select the correct picture from the board (Recognition Face) but to also

Table 26: Summary of Training Performance at Booster Sessions

	Booster 1			Booster 2			Booster 3		
	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
S1									
FT	16	15	11	6	11	10	10	16	6
CT	14	17	13	13	15	13	17	15	15
TT	30	32	24	19	26	23	27	31	21
LD	90	60	120	240	90	90	120	90	180
PC	0.47	0.53	0.54	0.68	0.58	0.57	0.63	0.48	0.71
S2									
FT	16	10	15	28	6	8	4	10	9
CT	19	13	17	13	15	15	14	15	14
TT	35	23	22	41	21	23	18	25	23
LD	60	90	60	40	180	120	240	60	90
PC	0.54	0.56	0.77	0.32	0.71	0.65	0.78	0.60	0.61
S3									
FT	4	3	3	7	3	1	8	6	3
CT	12	14	13	13	13	11	12	13	13
TT	16	17	16	20	15	12	20	19	16
LD	180	360	180	120	180	360	120	150	240
PC	0.75	0.82	0.81	0.65	0.87	0.92	0.60	0.68	0.81

Note. FT=Failed Trials, CT=Correct Trials, TT=Total Trials, LD=Longest Duration, PC=Proportion Correct.

being able to call the target by name after selecting the picture (Recognition Name). S3 consistently showed this pattern on LPT 2 of all three booster sessions. In addition, S2 improved in Booster Session 2 LPT 2, to being able to call the target by name when asked by the experimenter (Recall 2). S2 also showed this level of performance on LPT 2 in Booster Session 3. S1 continued to only be able to select the target's picture from the board (Recognition Face) but not correctly call her by name (Recognition Name) on LPT 2 of all Booster Sessions. The final live person transfer (LPT 3) was administered at a 72-hour delay. One participant (S2) was consistently able to call the target by name when asked by

Table 27: Transfer Task Performance at Booster Sessions

Participants		Recall 1	Recall 2	Recognition Face	Recognition Name
S1 booster session 1					
	LPT 1	0	0	1	0
	LPT 2	0	0	1	0
	LPT 3	0	0	1	1
S1 booster session 2					
	LPT 1	0	0	1	0
	LPT 2	0	0	1	0
	LPT 3	0	0	1	0
S1 booster session 3					
	LPT 1	0	0	1	0
	LPT 2	0	0	1	0
	LPT 3	0	0	1	0
S2 booster session 1					
	LPT 1	0	0	1	0
	LPT 2	0	0	1	1
	LPT 3	0	1	-	-
S2 booster session 2					
	LPT 1	0	0	1	1
	LPT 2	0	1	-	-
	LPT 3	0	1	-	-
S2 booster session 3					
	LPT 1	0	0	1	0
	LPT 2	0	1	-	-
	LPT 3	0	1	-	-
S3 booster session 1					
	LPT 1	0	0	1	0
	LPT 2	0	0	1	1
	LPT 3	0	0	1	1
S3 booster session 2					
	LPT 1	0	0	1	0
	LPT 2	0	0	1	1
	LPT 3	0	0	1	0
S1 booster session 3					
	LPT 1	0	0	1	0
	LPT 2	0	0	1	1
	LPT 3	0	0	1	0

Note. 0 = failed to recall or recognize, 1 = passed task and (-) indicates task was not administered due to success on the previous recall or recognition task. Recall 1 = spontaneously stating Target's name; Recall 2 = experimenter asks, 'Do you know my friend?'; Recognition Face = selecting Target picture from the board; Recognition Name = stating Target's name after looking at the picture.

the experimenter (Recall 2) at the LPT 3 on all three Booster Sessions. S1 and S3 showed the same pattern of performance on LPT 3 (72-hour delay) over the three booster sessions. Both participants (S1, S3) were able to correctly select the target's picture from the board (Recognition Face) and correctly call her by name (Recognition Name) at the 72-hour delay (LPT 3) in Booster 1. In Boosters 2 and 3, they were only able to identify the target picture (Recognition Face) but not call the target by name (Recognition Name). Two participants (S2, S3) showed improvement on LPT 2 in comparison to LPT 1 across all three booster sessions. S1 did not show improvement from LPT 1 to LPT 2 on any of the booster sessions. All three participants improved on LPT 3 in comparison to LPT 2 in booster session 1. In Booster 2 and 3, S2 was consistently able to call the target person by name (Recall 2) on LPT 2 and LPT 3. S3 dropped from LPT 2 to LPT 3 in both Booster session 2 and 3. While S1 showed no improvement in LPT 3 over Booster 2 and Booster 3. Overall, there was progressive improvement in the task for S2 over the three booster sessions but S1 and S3 actually performed best in Booster 1.

Immediate Recall during Booster Sessions. Table 28 contains the performance of the booster participants on the immediate recall task. As can be seen by looking in Table 28, participants performed inconsistently on the task in booster 1. In Booster Session 2, S2 and S3 were able to consistently free recall the target at the end of each Day. S1 was able to free recall the target on Day 2 but continued to perform inconsistently on the task; Day 1 selected target's picture, Day 3 selected target's picture and stated her name. By Booster Session 3, all three participants were able to free recall the target at the end of each day.

Delayed and Final Delayed Recall during Booster Sessions. Table 29 contains participants' performance on both the Delayed Recall (48 hr.) and the Final Delayed Recall

(72 hr.). The table reveals mixed performance on these tasks. S2 was the only participant ever able to consistently free recall the target at Delayed or Final Delayed Recall. S3 was able to free recall the target on Days 1 and 2 of Booster 1 and then again on Day 3 (72-hour delay) of Booster 2. S3 dropped off in Booster Session 3 and was never able to free recall the participant on this task during this week. S3 did select the target's picture consistently from the board when unable to free recall, except on Day 2 in Booster Session 3 where he was unsuccessful on all tasks. S1 was only able to call the target by name on Day 2 of Booster Session 2, however the participant was consistently successful at recognition of the target's picture from the board (Recognition Face) on every delayed recall task. Overall, participants showed mixed performance on the delayed and final recall tasks across booster sessions. These findings are similar to those of the booster session live person transfer tasks.

Table 28: Summary of Booster Session Performance on Immediate Recall

	Booster 1			Booster 2			Booster 3		
	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
S1	0/1/0	0/1/0	1/-/-	0/1/0	1/-/-	0/1/1	1/-/-	1/-/-	1/-/-
S2	0/1/0	1/-/-	0/1/1	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-
S3	0/1/0	0/1/1	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-
Total	0/3/0	1/2/1	2/1/1	2/1/0	3/0/0	2/1/1	3/-/-	3/-/-	3/-/-

Entries reflect Free Recall/Recognition Face/Recognition Name.
Note. . 0 = failed to recall or recognize and 1 = passed task, (-) indicates task was not administered due to success on the previous recall or recognition task.

Table 29: Summary of Booster Session Performance on Delayed and Final Delayed Recall

	Booster 1			Booster 2			Booster 3		
	Day 1 (48 hr)	Day 2 (48 hr)	Day 3 (72 hr)	Day 1 (48 hr)	Day 2 (48 hr)	Day 3 (72 hr)	Day 1 (48 hr)	Day 2 (48 hr)	Day 3 (72 hr)
S1	0/1/0	0/1/0	0/1/0	0/1/0	0/1/1	0/1/0	0/1/0	0/1/0	0/1/0
S2	1/-/-	0/1/1	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-	1/-/-
S3	1/-/-	1/-/-	0/1/0	0/1/0	0/1/0	1/-/-	0/1/0	0/0/0	0/1/0
Total	2/1/0	1/2/1	1/1/1	1/2/0	1/2/1	2/1/0	1/2/0	1/1/0	1/2/0

Entries reflect Free Recall/Recognition Face/Recognition Name.
Note. 0 = failed to recall or recognize and 1 = passed task, (-) indicates task was not administered due to success on the previous recall or recognition task.

Retest Performance: Retest Compared to Original Performance. Table 28a and 28b presents the number failed recall trials (FT), correct recall trials (CT), total recall trials (TT), proportion correct (PC) by session and longest retention interval duration (LD) successfully obtained in the first three original training sessions (Experiment 1) and the three training sessions at retest. Experiment 1 had a set number of training trials and at retest training trials were set with a time limit of 30 minutes, so for comparison purposes, we will be focusing on the proportion correct (PC) and the longest retention duration (LD) obtained. In the first session, all participants, regardless of group, showed a higher proportion correct and a longer retention interval obtained than their original testing except for S5-R who did not increase his LD at retest (see Table 30b). In session 1, the booster group (S1-R, S2-R, S3-R) performed quite well compared to original performance with improvements in proportion correct ranging from 0.19-0.25 and increases in longest duration ranging from 90 s to 280s (see Table 30a). In comparison, the no booster session gains were smaller, with

proportion correct improvements only ranging from 0.04 - 0.08 and longest duration increasing between 60 s and 70 s (see Table 30b).

In sessions 2 and 3 the pattern of larger proportion correct and lengthened longest duration continued for all participants, with the exception of S4-R in the no booster group. This participant performed extremely well at original testing and had to have a time limit set on training at 1.5 hours. As a result, S4-R's longest duration decreased at retest in both sessions 2 and 3. S4-R also has a decrease in proportion correct at session 2 retest. By session 2, the two no booster group participants that improved (S5-R, S6-R) obtained increases in proportions correct (0.24, 0.28) and longest duration (90 s, 160 s) that were more comparable to the booster group's increases (PC increase range: 0.11 - 0.32; LD increase range: 90 s – 290 s) (see Tables 30a and 30b). In session 3, the no booster group's performance (S5-R, S6-R) on proportion correct (PC increase range: 0.33 – 0.50) surpassed that of the booster group (PC increase range: 0.08 – 0.34). Increases in longest duration for session 3 were large for no booster participants that showed improvement (S5-R, S6-R), 180 s and 350 s, respectively. The booster session group also improved in longest duration, however their increases were more varied (S1-R: 30 s, S2-R: 320 s, S3-R: 120 s). These data are promising in that despite similar levels of cognitive functioning at original training and retest, as measured by the MMSE score (see Table 24), these participants were performing better at retest. These data provide new evidence that booster sessions may provide additional gains for participants at Retest. The benefit is most evident in the first retest training session, but the no booster group caught up by session 3 (see Table 30a and 30b).

Table 30a: Summary of Original Training Performance and Retest Performance

		Booster Group Participants					
		S1	S1-R	S2	S2-R	S3	S3-R
Session 1							
	FT	21	8	17	4	14	3
	CT	15	15	19	14	22	12
	TT	36	23	36	18	36	15
	PC	0.42	0.65	0.53	0.78	0.61	0.80
	LD	60	180	20	300	150	240
Session 2							
	FT	20	6	17	3	12	5
	CT	13	12	16	12	21	15
	TT	33	18	33	15	33	20
	PC	0.39	0.67	0.48	0.80	0.64	0.75
	LD	60	150	10	300	240	360
Session 3							
	FT	13	6	14	2	11	3
	CT	17	11	16	13	19	14
	TT	30	17	30	15	30	17
	PC	0.57	0.65	0.53	0.87	0.63	0.82
	LD	150	180	40	360	240	360

Table 30b: Summary of Original Training Performance and Retest Performance

		No Booster Group Participants					
		S4	S4-R	S5	S5- R	S6	S6-R
Session 1							
	FT	16	8	19	11	17	9
	CT	20	12	17	13	19	14
	TT	36	20	36	24	36	23
	PC	0.56	0.60	0.47	0.54	0.53	0.61
	LD	120	180	90	90	20	90
Session 2							
	FT	0	1	15	3	16	3
	CT	18	13	18	11	17	12
	TT	18	14	13	14	33	15
	PC	1.0	0.93	0.55	0.79	0.52	0.80
	LD	1080	360	90	180	20	180
Session 3							
	FT	0	0	16	3	17	1
	CT	18	13	14	12	13	13
	TT	18	13	30	15	30	14
	PC	1.0	1.0	0.47	0.80	0.43	0.93
	LD	1080	480	60	240	10	360

Note. FT=Failed Trials, CT=Correct Trials, TT=Total Trials, LD=Longest Duration, PC=Proportion Correct.

Comparison of Booster and No Booster Groups at Retest: General Impressions of Performance. Table 31 contains each participant's recall failures, recall successes, longest time interval duration and proportion correct across trials and training sessions by group. Overall, the positive effect of spaced retrieval training on recall of the correct name-face association is evident for all participants regardless of group. To be precise, the number of failed trials (FT) reduced from session 1 to session 3 for all but one participant (S3's FT remained stable). In addition, the longest duration (LD) increased for every participant from session 1 to session 3, except for S1 where the longest duration remained constant in session 1 and session 3. That is, most all participants were able to retain the correct name-face association for longer retention intervals across training sessions. Table 29 also contains each participant's session proportion correct by group. The proportion scores were calculated by dividing the number of correct trials by the number of total trials for each participant. The positive effect of spaced retrieval training is seen in all participants' proportion correct (PC) increasing across sessions, with the exception of S1 where the PC remained stable.

Individual Session Performance. In session 1, the booster session group (S1, S2, S3) outperformed the no booster session group (S4, S5, S6). Specifically, the booster group had fewer failed trials (FT) (M = 5.0) in comparison to the no booster session group (M = 9.33). In addition, the booster group (M = 240 s) was able to retain the name-face association for a longer duration (LD) than the no booster group (M = 120 s). Proportion correct (PC) also showed the booster group (M = .74) outperforming their no booster (M = .58) counterparts. These findings provide evidence that the booster sessions did aid in retaining the name-face association across time. In session 2, the performance of the two groups was mixed with no

Table 31: Summary of 6-month Retest Performance

		Booster Group				No Booster Group			
		S1	S2	S3	Mean	S4	S5	S6	Mean
Session 1									
	FT	8	4	3	5.00	8	11	9	9.33
	CT	15	14	12	13.67	12	13	14	13.00
	TT	23	18	15	18.67	20	24	23	22.33
	LD	180	300	240	240	180	90	90	120
	PC	0.65	0.78	0.80	0.74	0.60	0.54	0.61	0.58
Session 2									
	FT	6	3	5	4.67	1	3	3	2.33
	CT	12	12	15	13.00	13	11	12	12.00
	TT	18	15	20	17.67	14	14	15	14.33
	LD	150	300	360	270	360	180	180	240
	PC	0.67	0.80	0.75	0.74	0.93	0.79	0.80	0.84
Session 3									
	FT	6	2	3	3.67	0	3	1	1.33
	CT	11	13	14	12.67	13	12	13	12.67
	TT	17	15	17	16.33	13	15	14	14.00
	LD	180	360	360	300	480	240	360	360
	PC	0.65	0.87	0.82	0.78	1.0	0.80	0.93	0.91

Note. FT=Failed Trials, CT=Correct Trials, TT=Total Trials, LD=Longest Duration, PC=Proportion Correct.

group outperforming the other on all measures of name-face success. The no booster group (M = 2.33) had fewer failed trials (FT) than the booster group (M = 4.67). While the booster group (*M* = 270 s) was able to maintain the name-face association for a longer duration (LD) than the no booster group (*M* = 240 s). Evaluation of the proportion of correct trials (PC) in session 2 revealed the no booster group (*M* = 0.91) outperforming the booster group (*M* = 0.78). Session 3 found the no booster group outperforming the booster group on all name-face retention measures. The no booster group (*M* = 1.33) had fewer failed trials (FT) than the booster group (M = 3.67). The no booster group was also able to retain the association

for a longer duration (LD) than their booster counterparts, 360 s and 300 s, respectively. Finally, the no booster was highly successful in their proportion correct (PC) (M = 0.91) while the booster group was not as successful (M = 0.78).

Booster Group Detailed Training Analysis. In session 1 the booster group's proportion correct (PC) ranged from 0.65- 0.80 (see Table 31). In session 2, S1 and S2's proportion correct increased with scores of 0.67 and 0.80, respectively. S3's proportion correct dropped to 0.75 in session 2. By session 3, S3 improved to 0.82 proportion correct and S2 also improved to 0.87 proportion correct. S1, dropped slightly in session 3 to 0.65 proportion correct, caused by one less trial in this session. The pattern of longest duration (LD) differed for each participant. S1 started with a LD of 180 s in session 1, dropped slightly to an LD of 150 s in session 2 and then gained back to their original LD of 180 s in session 3. S2 was able to maintain the name-face association for 300 s in session 1 and 2 and then improved to a 360 s LD in session 3. S3 started off with a LD of 240 s in session 1 and then jumped to a LD of 360 s in session 2 which was maintained in session 3 as well. The booster group began the retest session 1 performing very well at maintaining the name-face associations (M = 240 s). Although there were slight variations in this group's pattern of training, overall the group maintained this level of performance throughout session 3. The booster sessions appeared to produce higher initial retention of the name-face association, as evidenced by strong performance in session 1.

No Booster Group Detailed Training Analysis. In session 1 the no booster group's proportion correct (PC) ranged from 0.54 - 0.61, which was less than the booster group (see Table 31). In session 2, all participants' proportion correct increased with S4 improving dramatically from 0.60 proportion correct in session 1 to 0.93 proportion correct in session

2. By session 3, all participants were continuing their gains with proportion correct scores ranging from 0.80 -1.00. The pattern of longest duration (LD) also showed a consistent pattern of improvement from session 1 to session 3 for all participants in the group. For example, S6 went from being able to retain the name-face association for 90 s in session 1 to retaining the name-face association to 360 s in session 3. The no booster group began retest session 1 able to retain the name-face association (M = 120 s) only half as long as their booster session counterparts (M = 240 s). However, the no booster group showed consistent improvement across sessions and surpassed the booster session group in session 3 with a longest duration of 360 s in comparison to the booster groups longest duration of 300 s. Overall, the no booster session group displayed a more consistent pattern of training performance and after three sessions was outperforming the booster session group on all measures of name-face association (failed trials, longest duration and proportion correct).

Table 32 presents the number of failed and passed trials by session and group. A series of *t*-tests on independent samples was run to determine if group performance differed by session. Tests were run on the proportion correct for each session by group, to control for differences in number of total trials. Proportion correct was calculated for each group by dividing the total number of passed trials in each group and dividing by the total number of trials per group. In session 1, the SR group (M = 0.74) performed better on the name-face task than the FI group (M = .058), $t(4) = 3.08$, $p < .05$. The analysis revealed no other significant effects.

Live Person Transfer Task

Table 33 contains each participant's performance on the live person transfer task by group. In general, most participants in both groups improved in recall and recognition of the

Table 32: Number of Failed and Passed Trials by Session and Group at Retest

Session 1			
	Pass	Fail	Total
Booster	41	15	56
No booster	39	28	67
	80	43	

Session 2			
	Pass	Fail	Total
Booster	39	14	53
No booster	36	7	43
	75	21	

Session 3			
	Pass	Fail	Total
Booster	38	11	49
No booster	38	4	42
	76	15	

target person on the last transfer task (LPT 3) in comparison to the first transfer task (LPT 1). The exception was S3 who actually decreased in performance from LPT 1 to LPT 3 and S6 who performed consistently on both LPT 1 and LPT 3. All participants in both groups recognized the target picture on Day 1 even though they did not know her name, except for S4 in the no booster session group who failed all tasks on Day 1. By the last transfer task (LPT 3, 72 hour delay), two of the booster session participants (S1, S2) were able to call the target by name when asked by the experimenter (Recall 2). In addition, two of the no booster session participants (S4, S5) were also able to call the live target by name; S4 called her by name spontaneously (Recall 1) and S5 called her by name when asked by the experimenter (Recall 2). The remaining two participants (S3, S6), one from each group, were able to select the target's picture from the board (Recognition Face) but not call her by name (Recognition Name). These results show little difference between the two groups on the live person transfer task.

Booster Group Detailed Transfer Task Analysis. At the first live person transfer task (LPT 1) no participants in the booster session group were able to successfully pass Recall Task 1 or Recall Task 2 (see Table 33). One participant (S3) was able to call the target by

Table 33: Transfer Task Performance at 6-month Retest

		Recall 1	Recall 2	Recognition Face	Recognition Name
Booster Group					
S1	LPT 1	0	0	1	0
	LPT 2	0	0	1	0
	LPT 3	0	1	-	-
S2	LPT 1	0	0	1	0
	LPT 2	0	1	-	-
	LPT 3	0	1	-	-
S3	LPT 1	0	0	1	1
	LPT 2	0	0	1	0
	LPT 3	0	0	1	0
No Booster Group					
S4	LPT 1	0	0	0	0
	LPT 2	0	0	1	1
	LPT 3	1	-	-	-
S5	LPT 1	0	0	1	0
	LPT 2	0	1	-	-
	LPT 3	0	1	-	-
S6	LPT 1	0	0	1	0
	LPT 2	0	0	1	0
	LPT 3	0	0	1	0

Note. 0 = failed to recall or recognize, 1 = passed task and (-) indicates task was not administered due to success on the previous recall or recognition task. Recall 1 = spontaneously stating Target's name; Recall 2 = experimenter asks, 'Do you know my friend?'; Recognition Face = selecting Target picture from the board; Recognition Name = stating Target's name after looking at the picture.

name (Recognition Name) after they correctly selected her picture from the board (Recognition Face). The other two (S1, S2) were able to correctly select the target's picture from the board (Recognition Face) but could not call her by name (Recognition Name). After three days of spaced retrieval training (LPT 2), one participant (S2) was now able to call the target by name when asked by the experimenter (Recall 2). The remaining two participants (S1, S3) were able to select the target's photograph from the board (Recognition

Face) but could not call her by name (Recognition Name). At LPT 3(72 hour delay), S2 continued to be able to call the target by name when asked by the experimenter (Recall 2), S1 improved to being able to call the target by name when asked by the experimenter (Recall 2) and S3 remained stable at only being able to select the target's picture from the board (Recognition Face).

Overall, the booster session group had success on the transfer tasks. All of the booster session participants were able to call the live target by name at some point during the retest transfer tasks. The results do not show large gains in recall and recognition of the live target by the booster group in comparison to the no booster participants. Details of performance by the no booster group are described next.

No Booster Group Detailed Transfer Task Analysis. On day 1 of the live person transfer task (LPT 1) no participants in the no booster session group were able to successfully pass Recall Task 1 or Recall Task 2 (see Table 33). Two participants (S5, S6) were able to correctly select the target's picture from the board (Recognition Face) but could not call her by name (Recognition Name). S4 did not pass any of the LPT 1 transfer tasks. After three days of spaced retrieval training (LPT 2), one participant (S5) was now able to call the target by name when asked by the experimenter (Recall 2). S1 improved to correctly selecting the target's picture from the board (Recognition Face) and correctly calling the target by name (Recognition Name). S6 remained stable at only selecting the target's picture from the board (Recognition Face). At LPT 3 (72 hour delay), S4 improved to being able to spontaneously call the target by name (Recall 1), S5 continued to be able to call the target by name when asked by the experimenter (Recall 2), and S6 remained stable at only being able to select the target's picture from the board (Recognition Face).

Overall, the no booster session group demonstrated success the transfer tasks. Two of the three participants were able to call the live target by name at some point during the retest live person transfer tasks. The results demonstrate that even without booster sessions, previous spaced retrieval training grains on a name-face association and transferring that association to a live person may be accessible at a 6-month retest.

Table 34 lists the number of passed and failed recalls at transfer task by group at Retest. A passed recall was awarded if the participant spontaneously recalled the target (Recall 1) or recalled the target when asked by the experimenter (Recall 2). A Cochran test, which evaluates differences among related proportions, was run on each group's performance on recall across transfer tasks. There were no significant differences among performance across the four transfer tasks for either group (both booster and no booster group $Q = 3.00$, $p = .22$).

Table 34: Transfer Task Recall Performance by Group at Retest

	LPT 1		
	Pass	Fail	Total
Booster	0	3	3
No booster	0	3	3
	0	6	

	LPT 2		
	Pass	Fail	Total
Booster	1	2	3
No booster	1	2	3
	2	4	

	LPT 3		
	Pass	Fail	Total
Booster	2	1	3
No booster	2	1	3
	4	2	

Note. A pass indicates the participant called the target by name spontaneously (Recall 1) or when asked by the experimenter (Recall 2).

Explicit Memory for the Target Person

Immediate Recall/Recognition. At the end of each training session participants were asked to free recall, or recognize if they were unable to recall, the target person.

Tables 35a and 35b show the results for each participant by group. After the first day of training, all three of the booster session participants were able to free recall the target person (see Table 35a). In contrast, none of the no booster session participants were able to free recall the target (see Table 35b). One participant (S5) was able to select the target's picture from the board (Recognition Face) and then state the correct name (Recognition Name). One participant (S6) had success at selecting the correct picture from the board (Recognition Face) but was unable to state the target's name. The last participant in the no booster group (S4) did not pass any of the recall or recognition tasks on day 1. On Day 2, all of the booster session participants continue to be able to free recall the target at immediate recall. After two training sessions, two participants (S4, S6) in the no booster session group were also able to free recall the target. The remaining no booster group participant, S5, continued to have success at both of the Recognition Tasks. After three spaced retrieval training sessions, the booster session group had 2 participants (S2, S3) that were able to free recall the target and one participant (S1) that was only able to select the target's picture from the board (Recognition Face) but could not state the target name (Recognition Name). All members of the no booster session group were now able to free recall the target. The findings from the immediate recall data show the booster session group outperformed the no booster session group on Day 1 and Day 2 of training. However, similar to the spaced retrieval training performance, the no booster session group performed well on the immediate recall task after 3 training sessions.

Participant's scores on immediate free recall of the target were evaluated by group to determine performance differences across session. A passed recall was awarded if the participant spontaneously recalled the target when asked by the experimenter to recall the

Table 35a: Summary of Immediate Recall for Booster Group

		Participants		
Recall / Recognition Face / Recognition Name		S1	S2	S3
	Day 1	1/-/-	1/-/-	1/-/-
	Day 2	1/-/-	1/-/-	1/-/-
	Day 3	0/1/0	1/-/-	1/-/-
	Total	2/1/0	3/-/-	3/-/-

Table 35b: Summary of Immediate Recall for No Booster Group

		Participants		
Recall / Recognition Face / Recognition Name		S4	S5	S6
	Day 1	0/0/0	0/1/1	0/1/0
	Day 2	1/-/-	0/1/1	1/-/-
	Day 3	1/-/-	1/-/-	1/-/-
	Total	2/0/0	2/2/2	2/1/0

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task.

photograph that had just been used during training. A *t*-test on independent samples was run to determine if group performance differed by session. The analysis revealed no significant effects between the groups on individual session performance.

Delayed Recall. Each participant's performance by group on the delayed recall task can be found in Tables 36a and 36b. After the first day of training none of the participants from either group was able to free recall the target at delayed recall (48 hr). All of the booster

session groups were able to select the target's picture from the board (Recognition Face) but they were unable to state the target's name (Recognition Name). Two of the no booster session participants (S4, S6) were performing similarly with success on Recognition Face but no success on Recognition Name. The remaining no booster session group participant, S5, was not successful at any of the Recall or Recognition tasks after Day 1. After two spaced retrieval training sessions, the groups performed comparably on the Delayed Recall task. One booster session participant (S2) and one no booster session participant (S4), were able to free recall the target at the 48 hr. delay. Two booster session participants (S1, S3) and two no booster session participants (S5, S6) were able to select the target's picture from the board (Recognition Face) but were unable to state the target name (Recognition Name). To summarize, only one participant from each group (S2, S4) was ever able to free recall the target at a 48-hour delay. All remaining participants (S1, S3, S5, S6) were able to at least recognize the target picture (Recognition Face) at the Delay. The results of the Delayed Recall task demonstrate comparable performance by the two groups.

Participant's scores on delayed free recall of the target were evaluated by group to determine performance differences across tasks. A passed recall was awarded if the participant spontaneously recalled the target when asked by the experimenter to recall the photograph used during the prior training session. A *t*-test on independent samples was run to determine if group performance differed by session. The analysis revealed no significant effects between the groups on individual session performance.

Final Delayed Recall. Table 36a and 36b contain participants' scores on the final delayed recall task (72 hour delay). One participant in each group (S2, S4) was able to free recall the target by name at the 72-hour delay. One participant (S5) in the no booster session

Table 36a: Summary of Delayed and Final Delayed Recall for Booster Group

	Participants			
Recall / Recognition Face/ Recognition Name	S1	S2	S3	Total
Day 1 (48hr)	0/1/0	0/1/0	0/1/0	0/3/0
Day 2 (48hr)	0/1/0	1/-/-	0/1/0	1/2/0
Day 3 (72hr)	0/1/0	1/-/-	0/1/0	1/2/0
Total	0/3/0	2/1/0	0/3/0	

Table 36b: Summary of Delayed and Final Delayed Recall for No Booster Group

			Participants	
Recall / Recognition Face/ Recognition Name	S4	S5	S6	Total
Day 1 (48hr)	0/1/0	0/0/0	0/1/0	0/2/0
Day 2 (48hr)	1/-/-	0/1/0	0/1/0	1/2/0
Day 3 (72hr)	1/-/-	0/1/1	0/1/0	1/2/1
Total	2/1/0	0/2/1	0/3/0	

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task.

group was able to select the target's picture from the board (Recognition Face) and call the target by name (Recognition Name). The remaining 3 participants (S1, S3, S6) were able to select the target's picture from the board (Recognition Face) but were unable to call the target by the correct name (Recognition Name). These findings are similar to both the retest immediate recall and delayed recall data in that the two groups performed similarly, with the no booster session group performing slightly better. Overall, two no booster session

participants were able to identify the target picture by name, while only one participant in the booster session group was able to so.

Participant's scores on the final delayed free recall of the target were evaluated by group to determine performance differences on free recall after a 72 hour delay. A passed recall was awarded if the participant spontaneously recalled the target when asked by the experimenter to recall the photograph used during the prior week of training. A *t*-test on independent samples was run to determine if group performance differed on the task. The analysis revealed no significant effects between the groups on performance.

Quality of Life

Table 37 contains participants' performance on the Dementia Quality of Life Measure (DQoL) at the end of initial spaced retrieval training (Post) and at 6-month retest. Both groups performed somewhat better on average on most scales of the DQoL at retest in comparison to Posttest Training (see Table 37). The booster group performed comparably on two of the scales: absence of negative affect and sense of aesthetics. The no booster group performed lower on the self-esteem scale and on the overall quality of life question at retest. When comparing performance at retest by group the no booster group scored higher on all scales in comparison to their booster group counterparts except on the feelings of belonging scale. The finding that the no booster group performed slightly higher than the booster group lends support to the idea that something beyond social contact is improving these participants feelings about their quality of life. The one scale the booster group (M = 4.34) does outperform the no booster group (M = 3.89) on is feeling of belonging, which one could speculate may be impacted by social contact. Independent samples *t* tests were run to determine differences between groups at pretest and posttest on the six scales that comprise

Table 37: DQoL at Retest

	Scales					
	Self-Esteem	Positive Affect	Absence of Negative Affect	Feelings of Belonging	Sense of Aesthetics	Overall Quality of Life
Booster						
S1 Post	3.75	3.67	2.82	3.33	4.00	2.00
Retest	4.50	4.17	3.36	3.67	4.40	4.00
S2 Post	4.50	3.67	4.18	4.00	4.00	4.00
Retest	3.75	4.17	4.18	4.67	3.00	4.00
S3 Post	3.75	4.83	4.27	4.67	3.20	4.00
Retest	4.75	4.17	3.64	4.67	3.80	4.00
M Post	4.00	4.06	3.76	4.00	3.73	3.33
M Retest	4.33	4.17	3.73	4.34	3.73	4.00
No Booster						
S4 Post	4.75	4.50	3.91	4.67	5.00	4.00
Retest	4.25	5.00	4.27	4.67	5.00	4.00
S5 Post	4.50	4.00	5.00	2.67	1.00	5.00
Retest	5.00	4.83	5.00	3.33	4.33	4.00
S6 Post	4.50	3.83	3.36	4.00	3.40	3.00
Retest	4.25	4.00	3.91	3.67	3.00	3.00
M Post	4.58	4.11	4.09	3.78	3.13	4.00
M Retest	4.50	4.61	4.39	3.89	4.11	3.67

the DQoL. No significant effects resulted from the analysis. The fact that the no booster group performed slightly better on several scales in the DQoL and they outperformed the booster group on spaced retrieval training in session three, may offer support to the idea that success on the name-face task could improve Alzheimer's participant's quality of life. Due to the mild gains observed on the DQoL at retest, further research is warranted.

Experiment 2 Discussion

Three main findings emerge from this study; first, these data provide evidence to the long-term effectiveness of spaced retrieval for a time interval of 6-months. We found evidence of a benefit of prior task experience on spaced retrieval performance in the retested performance compared to their original performance. In general, the within-subjects comparisons revealed all participants (with the exception of S5-R session 1 and S4-R sessions 2 and 3) showed increases in proportion correct and longer durations at time of Retest in comparison to original testing. Overall, these findings suggest that the benefits of prior spaced retrieval training are evident at a 6-month retest. Second, we found evidence that additional training or booster sessions within the retest period can lead to better training effects, at least initially. The finding that all booster session participants performed considerably better at retest in comparison to original test is encouraging. The results provided here of booster session participants outperforming non booster participants, at least in the first training session, is similar to findings by Cherry & Simmons-D'Gerolamo (2005) that found memory retention at retest of 6 months and even 11 months with a participant previously trained using SR. Third, there is preliminary evidence that quality of life, as measured by the DQoL, in Alzheimer's patients may be affected by performance on the spaced retrieval task.

The findings from Experiment 1 clearly showed the spaced retrieval paradigm is useful in training persons with Alzheimer's on a non-familiar name-face association and transferring that association to a live person target. In addition, Experiment 2 provided evidence of long-term effectiveness of the training. These findings led to investigation of the more ecologically valid task of training persons with Alzheimer's disease on a familiar name-face association. Experiment 3 was designed to explore the efficacy of training cognitively impaired older adults on a familiar face, a task that would be relevant to the patient and their caregivers.

EXPERIMENT 3

Participants

A total of five persons with mild to moderate AD were recruited from a local assisted living center. These persons had not participated in prior SR experiments so that they had no prior spaced retrieval training experience. All participants received spaced retrieval training on a familiar name-face association on alternate days of the week, across a four-week period. All participants met the same inclusion/exclusion criteria described in the general method. A summary of demographic and health characteristics of the sample is located in Table 38 and Table 39. Table 38 includes information reported by the primary caregivers, while Table 39 is self reported information.

Individual Difference Measures

To obtain a cognitive profile of each participant, the same measures administered in Experiment 1 were also administered in this experiment. The following measures were completed: the Mini Mental State Exam (MMSE), the Geriatric Depression Scale (GDS), short-form of the WAIS, and a series of subject-performance tasks. Table 40 contains a summary of all measures of individual differences administered to each participant.

The MMSE (Folstein, Folstein, & McHugh, 1975) was used to provide an index of current cognitive status. The maximum score on the MMSE is 30. On this measure, healthy older adults scores range from 27 to 30. For the current sample, scores range from 9 to 18, indicating cognitive impairment (see Table 40). S4 had a score of 9 on the MMSE. The typical cutoff score for the study on the MMSE was a score of 12. This participant had a severe verbal deficit, which impacted her score on the MMSE. S4 demonstrated the ability

Table 38: Summary of Demographic and Health Characteristics (caregiver-reported)

	Participants					
Measure	S1	S2	S3	S4	S5	Mean
Age	77	89	88	67	82	80.6
Gender[a]	2	2	1	2	2	-
Race[b]	1	1	1	1	1	-
Marital status[c]	4	4	4	3	4	-
Years of education[d]	4	6	6	5	5	5.2
Occupation level[e]	3	4	5	5	4	-
No. of chronic diseases[f]	2	3	3	3	3	2.8
No. of physician prescribed medications[g]	3	3	3	3	3	3.0

Note. [a]1=male, 2=female. [b]1=white, 2=black. [c]1=single, 2=married, 3=divorced, 4=widowed. [d]1=less than 7th grade, 2=7th - 9th grade, 3=10th – 11th grade, 4=high school degree, 5=partial college or specialized training, 6=college degree, 7=graduate degree. [e]1=unskilled, 2=semi-skilled, 3=skilled, 4=semi-professional, 5=professional. Professions included, homemaker, sales clerk, Marine Colonel and supervisor. [f]higher scores reflect more health problems. [g]1=none, 2=1 to 3, 3=4 to 6, 4=over 6.

to follow directions and successfully complete the SR task and was allowed to participate in the training program.

To obtain a measure of affective status, the GDS (Yesavage et al., 1983) was administered. Scores between 6 and 10 on the GDS represent mild depression. The scores from the current sample ranged from 0 to 6, with only one participant, S2, indicating the appearance of mild depression at the time of testing (see Table 40). The short-form of the WAIS vocabulary test (Jastak & Jastak, 1965) was utilized as a measure of general intellectual functioning as well as verbal ability. A maximum score of 40 is possible on the

Table 39: Summary of Health and Social Activity Characteristics (self-reported)

	Participants				
Measure	S1	S2	S3	S4	S5
Self-perceived health[a]	1	2	2	3	1
Health prevents activities[b]	1	2	1	1	2
Health compared with others[c]	3	1	1	3	1
No. of times per week for visitors[d]	3	N/A	2	2	4
No. of activities at facility per week[e]	3	4	1	4	4
No. of community activities outside facility[f]	1	1	1	1	1
No. of hours per week spent outside of home[g]	2	N/A	1	2	2

Note. All ratings were made on a 3 to 5-point Likert scale. [a]1=excellent to 4=poor. [b]1=not at all to 3=a great deal. [c]1=better to 3=poorer. [d]higher scores reflect increased number of times. [e,f]higher scores reflect more activities. [g]higher scores reflect more time. N/A=no answer given.

vocabulary subtest. Participant's scores ranged from 5 to 19, indicating a deficiency in general intellectual functioning and verbal ability.

The Forward Digit Span and the Backward Digit Span from the WAIS were used to obtain a measure of short-term memory and working memory, respectively. The highest possible score is 9.0 on the FDS and 8.0 on the BDS. On the FDS, the current sample scores were between 3.0 and 4.5, suggesting deficits in short-term memory. Scores on the BDS were between 0 and 3.0, suggesting working memory impairment (see Table 40). Lastly, participants were given series of subject-performed tasks adapted from Cherry, Simmons, and Camp (1999) as a measure of secondary memory ability. In this task 10 items were

Table 40: Summary of Individual Difference Measures

	Participants				
Measure	S1	S2	S3	S4	S5
Age	77	89	88	67	82
MMSE[a]	12	14	12	9	18
GDS[b]	5	6	5	0	0
Vocabulary[c]	5	8	12	9	19
FDS[d]	3.0	4.0	4.0	3.0	4.5
BDS[d]	0.0	3.0	2.0	0.0	2.5
Subject Performed Tasks[e]					
Free Recall					
Correct (S)	0	1	0	0	2
Correct (L)	0	2	0	0	2
Cued Recall					
Correct (S)	4	6	0	0	5
Correct (L)	5	7	6	6	6

[a]Mini-Mental State Exam (MMSE, Folstein, Folstein, & McHugh, 1975).
[b]Geriatric Depression Scale (GDS, Sheikh & Yesavage, 1986).
[c]Vocabulary Score, Short-Form of the WAIS Vocabulary test (Jastak & Jastak, 1965).
[d]Forward Digit Span (FDS) and Backward Digit Span (BDS) from the Wechsler Adult Intelligence Scale (Wechsler, 1955).
[e]Subject-performed tasks (SPT) (Cherry, Simmons & Camp, 1999).

presented and participants were asked to perform a specific action with each item. The task was scored based on a strict (i.e., verbatim) and lenient (i.e., strict and semantically parallel) criteria for both free recall and cued recall of the objects and the actions. Overall, free recall of the objects and actions were low, regardless of implementing the strict or lenient criteria,

as can be seen in Table 40. Memory for the object and action improved when the participants were presented with the object as a cue in the cued recall task. These findings suggest large deficits in secondary memory for the current sample. The improvement of participants in the cued recall task underscores the importance of computing separate scores for free recall and cued recall.

Baseline Measures of Memory

We also administered the two secondary memory measures, the prospective nametag task and the shirt color naming task, across sessions as described in the General Method. The prospective nametag task provided a baseline measure of memory for a simple verbal cue/motor response association without the benefit of spaced retrieval training. Participants were given a series of prompts as reminder to turn in their nametags. The maximum points per day on this task is 4, indicating the participant turned in their nametag upon hearing the cue, 'We are finished for the day' the first time. A score of zero indicated the participant never remembered to turn in their nametag. Points are reduced based on the number of times the prompt is offered. The shirt color task was given as a measure of 48 hour or 72 hour delayed recall of single item information without the benefit of spaced retrieval training. Participants were asked to recall the color of the shirt the experimenter was wearing in the previous session. The shirt color task is scored as pass or fail; with 1 indicating passed the task and 0 indicating failed the task.

Prospective Nametag Task. The results for the prospective nametag task appear in Table 41. For each participant, a total score was calculated by summing the nametag task score from each of the twelve sessions. The highest possible score was 48 points. Total scores for each participant are as follows: S1= 2 points, S2 = 0 points, S3 = 2 points, S4 = 4

points, S5 = 9 points. Participants did not consistently remember to turn in their nametags. Performance on this task was very mixed; one participant, S5, remembered to turn in her nametag on during days 3-5, S4 remembered in the following week, during days 6-8, two additional participants (S1, S3) remembered in days 9-11 and the remaining participant, S2, never remembered to turn in her nametag. In general, most participants did not remember to turn in their nametags until several cues had been given. Overall, participants did very poorly on this task and there is only minimal improvement in scores for most participants across sessions.

Shirt color naming task. Participants received a score of zero if they could not remember the color of the shirt the experimenter was wearing in the previous session and a score of 1 was awarded if the participant correctly remembered the shirt color. The participant scores were totaled across sessions out of a maximum score of 11. The scores here were as follows: S1 = 0, S2 = 0, S3 = 1, S4 = 0, S5 = 4. Only two participants ever correctly recalled the color of shirt from the previous session; S3 on day 9 and S5 on days 6, 9, 10 and 12. These results continue to highlight the observed deficits in free recall typically seen in persons with Alzheimer's disease.

Procedure

The same materials and procedure were used as described in the general method. Individual sessions were conducted in a private area of the adult assisted living center on alternate days of the week, across a four-week period. Participants completed nine SR training sessions that lasted for 30 minutes or until the participant expressed fatigue. The three measures of explicit memory (immediate recall, 48 hour delayed recall and a 72 hour final recall) for the name-face association were also administered as described in the General

Table 41: Summary of Nametag Task Performance

	Participants				
	S1	S2	S3	S4	S5
Days 1-2	0	0	0	0	0
Days 3-5	0	0	0	0	1
Days 6-8	0	0	0	2	1
Days 9-11	1	0	1	2	5
Day 12	1	0	1	0	2
Total	2	0	2	4	9

Note. Score is based on a maximum score possible of 48.

Method (see Table 9 for a summary of each session). The only difference in this experiment is that participants were trained on a target photograph that was a familiar face. The same 8 distractor (non-familiar) pictures were used for all participants. The criteria for the familiar target was someone the participant came into contact with approximately once a week and someone the participant did not reliably call by name, based on caregiver and staff report. The experimenter used a digital camera to photograph the familiar target and the photo was adapted for use in the SR training trials. The familiar target was also required to participate in all four live person transfer tasks. For each participant, caregiver(s) assisted in selecting an appropriate person to serve as the 'familiar' target.

Target and Participant Interaction. Caregivers were asked to keep a record of participant and target person's interactions throughout the period of SR training to control for level of exposure to this person across participants (see Appendix C). Table 42 contains information about target and participant exposure. Inspection of the table reveals that the 'familiar' target for all persons was either a family member or the activity director at the assisted living facility.

All participants had interaction with the target at least one time per week for intervals ranging from 10 minutes to 2 hours, with the exception of S1 in week 1, who did not see the target during that time period. Two participants called the target by name during these interactions, S2 during week 3 and S5 over all three weeks of training (see Table 42).

Results

Spaced Retrieval Training Trials: General Impressions of Performance. Table 43 contains each participant's recall failures (FT), recall successes (CT), total trials attempted (TT), proportion correct (PC) and longest time interval duration (LD) in seconds across trials and training sessions. Overall, the positive effect of spaced retrieval training on recall of the correct name-face association is evident for the majority of participants. To be precise, the proportion correct (PC) increased from session 1 to session 9 for all participants, except for S1 who was unable to perform the SR task across all sessions. In addition, the longest duration increased for most all participants from session 1 to session 9, except for S2 who produced the same longest duration (LD) in session 1 and session 9. That is, most participants were able to retain the correct name-face association for longer retention intervals across training sessions.

Table 42: Summary of Target and Participant Interaction during Training

	Target Person	Week 1			Week 2			Week 3		
		No. of visits	Total length of visit(s)	Target called by name?	No. of visits	Total length of visit(s)	Target called by name?	No. of visits	Total length of visit(s)	Target called by name?
S1	Niece	0	-	-	1	½ hr	No	1	½ hr.	No
S2	Daughter	1	2 hrs	No	2	3 hrs	No	1	2 hrs	Yes
S3	Activities Director	1	10 min.	No	1	10 min.	No	3	20 min.	No
S4	Son-in-Law	1	15 min.	No	1	30 min.	Yes	1	20 min.	No
S5	Activities Director	3	15 min.	Yes	3	15 min.	Yes	3	15 min.	Yes

Table 43: Summary of Spaced Retrieval Task Performance

		Participants					
		S1	S2	S3	S4	S5	Mean[6]
Week 1							
Session 1	FT	36	18	25	34	10	22
	CT	0	14	14	4	12	8.80
	TT	36	42	39	38	22	28.20
	PC	0	0.33	0.36	0.11	0.55	0.34
	LD	0	40	20	5	90	39
Session 2	FT	36	21	8	23	5	14
	CT	0	20	13	5	14	10.40
	TT	36	41	21	28	19	21.80
	PC	0	0.49	0.62	0.18	0.74	0.51
	LD	0	40	90	5	240	94
Session 3	FT	36	27	8	24	3	16
	CT	0	15	13	12	13	13.25
	TT	36	42	21	36	16	28.75
	PC	0	0.36	0.62	0.33	0.81	0.53
	LD	0	20	90	10	300	105
Week 2							
Session 4	FT	36	14	10	29	5	15
	CT	0	11	12	9	15	11.75
	TT	36	25	22	38	20	26.25
	PC	0	0.44	0.55	0.24	0.75	0.50
	LD	0	60	90	10	240	100
Session 5	FT	36	16	4	9	0	7
	CT	0	16	12	12	12	13.00
	TT	36	32	16	21	12	20.25
	PC	0	0.50	0.75	0.57	1.0	0.71
	LD	0	60	150	60	360	158
Session 6	FT	36	16	1	11	0	7
	CT	0	14	12	13	12	12.75
	TT	36	30	13	24	12	19.75
	PC	0	0.47	0.92	0.54	1.0	0.73
	LD	0	120	300	60	360	210

Table 38 continued

[6] Mean was computed including scores from those participants who learned the SR task; S2, S3, S4, S5.

Week 3

Session 7	FT	36	14	6	2	0	6
	CT	0	15	13	11	12	12.75
	TT	36	29	20	13	12	18.50
	PC	0	0.52	0.65	0.85	1.0	0.76
	LD	0	40	180	180	360	190
Session 8	FT	36	18	4	5	0	7
	CT	0	13	10	10	12	11.25
	TT	36	31	14	15	12	18.00
	PC	0	0.42	0.71	0.67	1.0	0.70
	LD	0	40	180	120	360	175
Session 9	FT	36	19	7	1	0	7
	CT	0	16	12	11	12	12.75
	TT	36	35	19	12	12	19.50
	PC	0	0.46	0.63	0.92	1.0	0.75
	LD	0	40	120	240	360	180

Note. FT=Failed Trials, CT=Correct Trials, TT=Total Trials, PC=Proportion of Correct Trials (CT/TT), LD=Longest Duration in seconds.

S1: Detailed SR Training Analysis. S1's performance on the actual spaced retrieval training trials was very poor. This participant was never able to associate the sound of the buzzer with the task of handing the experimenter the target photograph and stating the target's name. When specifically asked by the experimenter the name of the target person during training, the participant would respond correctly on a consistent basis across sessions.

S2: Detailed SR Analysis. In session 1, S2 reached a time interval of 40 s. In session 9 that interval remained stable at 40 s. S2 showed improvement in her longest time duration in week 2 were she improved to durations of 60 s in sessions 4 and 5 and reached 120 s in session 6. In week 3, sessions 7-9, she dropped down to her first week's longest duration of 40 s.

S3: Detailed SR Training Analysis. S3 received spaced retrieval training over a total of five weeks rather than four weeks. S3 fell at the assisted living center and was

hospitalized for three days after his second completed week of SR training. The participant was given one week off and training began again after the week delay. The MMSE was given after hospitalization to ensure no cognitive decline had occurred as a result of the fall. The MMSE score was unchanged at 12. In session 1, S3 reached a longest time interval of 20 s. In session 6, the longest time interval increased to 300 s. This shows a retention advantage 15 times that of the first session. In week 3, after a week delay in training, S3 reach a longest duration of 180 s. He maintained this retention interval in session 8 and dropped to 120 s longest duration in the session 9.

S4: Detailed SR Analysis. S4 is the youngest participant and also the most cognitively impaired in comparison to the other participants (see Table 40). S4 had severe verbal impairment, which likely impacted her score on the MMSE. In session 1, S4 reached a longest duration of only 5 s. By the end of week 1, session 3, the retention interval had only improved to a 10 s. By the end of the third week of training, session 9, S4 had reached a retention interval of 240 s, an increase of over forty eight times that of session 1. S4 increased across sessions, with the exception of session 8, in which her longest duration dropped from 180 s in session 7 to 120 s in session 8.

S5: Detailed SR Training Analysis. In session 1, S5 reached a 90 s time interval. S5 continued to improve across sessions during week 1. In session 4, S5 dropped to a longest duration of 240 s, but thereafter increased her longest duration to 360 s. With 0 failed trails, she consistently performed at 1.00 proportion correct throughout the remainder of the training sessions.

Live Person Transfer Task

General Impressions of Performance. Table 44 contains each participant's performance on the live person transfer task. Overall, most participants improved on the task from week 1 to week 3 (with the exception of S1), although S4's performance from name recall (Recall 2) in the first week to face recognition only decreased in the remaining sessions. In week 1, two participants (S4, S5) could recall the target by name when asked by the experimenter (Recall 2). All remaining participants (S1, S2, S3) recognized the target picture (Recognition Face) in week 1 even though they did not know her name (Recognition Name). In week 2, S3 spontaneously called the live target by name (Recall 1). In addition, two participants (S2, S5) called the target by name when asked by the experimenter (Recall 2). The remaining participants (S1, S4) only selected the target's picture (Recognition Face) but could not call her by name (Recognition Name). In week 3, two participants had success on the recall tasks. S5 spontaneously called the live target by name (Recall 1) and S2 continued to call the live target by name when asked by the experimenter (Recall2). S3 was able to select the target's picture from the board (Recognition Face) and call the target by name (Recognition Name). S1 and S4 only selected the target's picture from the board (Recognition Face) but could state their name (Recognition Name). At the 72 hour delay three participants (S2, S3, S5) called the target by name when asked by the experimenter (Recall 2). All participants, except for S1, were able to free recall the target at some point during the transfer tasks. A more detailed analysis of each participant's performance follows.

Table 44: Summary of Transfer Task Performance

		Recall 1	Recall 2	Recognition Face	Recognition Name
S1	Week 1	0	0	1	0
	Week 2	0	0	1	0
	Week 3	0	0	1	0
	72 hr. delay	0	0	1	0
S2	Week 1	0	0	1	0
	Week 2	0	1	-	-
	Week 3	0	1	-	-
	72 hr. delay	0	1	-	-
S3	Week 1	0	0	1	0
	Week 2	1	-	-	-
	Week 3	0	0	1	1
	72 hr. delay	0	1	-	-
S4	Week 1	0	1	-	-
	Week 2	0	0	1	0
	Week 3	0	0	1	0
	72 hr. delay	0	0	1	0
S5	Week 1	0	1	-	-
	Week 2	0	1	-	-
	Week 3	1	-	-	-
	72 hr. delay	0	1	-	-

Note. 0 = failed to recall or recognize, 1 = passed task and(-) indicates task was not administered due to success on the previous recall or recognition task . Recall 1 = spontaneously stating Target's name; Recall 2 = experimenter asks, 'Do you know my friend?'; Recognition Face = selecting Target picture from the board; Recognition Name = stating Target's name after looking at the picture.

S1: Detailed Transfer Task Analysis. In week 1 of the live person transfer task, S1 was unable to recall the target person but was able to recognize the target picture although not remember the target's name. This pattern continued throughout all live person transfer tasks. Although not intended to be on a fixed interval schedule, this participant ended up receiving this, rather than a true spaced retrieval training program. Interestingly, her results

on the live person transfer task look similar to those participants in the fixed interval group in Experiment 1(see Table 15b, Experiment 1). S1 consistently recognized the target but even after 36 trials in each of 9 training sessions she was unable to recall the correct name-face association or transfer that association to the live target. S1 highlights the individual variability found in persons with Alzheimer's disease. Although all inclusion criteria for participation in the study were met, she was still unable to fully participate in this particular spaced retrieval training program. Typically, practice trials are not included in the spaced retrieval paradigm as the lowest time interval (5 sec.) in SR training is the interval practice trials would be set (as in Experiment 1). Adapting the use of practice trials as in Experiment 1 may be helpful to ensure participants can fully participate in future SR training programs.

S2: Detailed Transfer Task Analysis. In week 1 of the live person transfer task, S2 was unable to recall the target person. S2 recognized the target picture although she did not remember the target's name. For all remaining transfer tasks, including the 72 hour delay, S2 was able to call the live person target by name when asked by the experimenter. In addition, on the transfer tasks in week 2 and week 3, S2 spontaneously stated the target's middle name along with the name she had been trained on via spaced retrieval. This spontaneous recall continued outside of the training sessions when S2 called her daughter by both her first and middle name when the daughter came to visit in week 3 (see Table 42).

S3: Detailed Transfer Task Analysis. In week 1 of the live person transfer task, S3 was unable to recall the target. S3 recognized the target picture although he did not remember the target's name. By the second transfer task (week 2), S3 spontaneously recalled the live target's name when she walked up to the testing table (Recall 1). In week 3, after a week delay in testing, S3 was unable to free recall the target (Recall 1 or 2) but

was able to select her photograph from the board (Recognition Face) and call her by name (Recognition Name). At the last transfer task (72 hour delay), S3 improved to call the target by name when asked by the experimenter (Recall 2). S3's performance on the live person transfer tasks was quite remarkable considering there was a one week delay in his training between weeks 2 and 3. The fact that he was still able to retain the learning of the name-face association and free recall the target at the 72 hour delay is promising.

S4: Detailed Transfer Task Analysis. In the first week of the live person transfer, S4 was able to recall the target by name when asked by the experimenter (Recall 2). This finding is particularly striking in that S4 could retain the name-face association for no more than 5 seconds in session 1 and by the end of the week was able to transfer that association to the actual person. In week 2, S4 declined on this task to only being able to select the target's picture but not state his name. This pattern continued for the remaining 2 transfer tasks (week 3 and 72-hour delay). During the last week of training, S4 began calling the participant a blend of two names. Rather than the target's name, Blaine, she referred to him as Brain. This is believed to be the result of her mixing up her primary caregiver at the adult day center, Brandon, with the target, Blaine. Had we accepted this 'blend' as correct, S4 would have scored higher on the last two transfer tasks. When asked by the experimenter the name of the target (Recall 2) she responded, Brain, in week 3 and at the 72 hour delay. Her performance on this task is noteworthy considering her verbal deficits and that she was unable to retain the association in session 1 for longer than 5 s.

S5: Detailed Transfer Task Analysis. In the first week of the live person transfer task, after only one week of training, S5 was able to call the live target by name when asked by the experimenter (Recall 2). She continued to have success on this task (Recall 2) into week

2. In week 3, S5 spontaneously called the target by name when the target approached the testing table (Recall 1). At the 72 hour delay, S5 remained able to call the target by name when asked by the experimenter (Recall 2). This finding is particularly exciting because it provides evidence that name-face associations trained with the spaced retrieval method on a familiar face may transfer to the live person after fewer weeks of training, in this case one week of training. In addition, this participant applied the name-face outside of the testing sessions. The participant consistently called the target by name when she would see her at the assisted living center, even though her contact with the target was minimal, consisting of visits totaling 15 minutes per week (see Table 42).

Participant's scores on recall of the target at transfer task were evaluated to determine performance differences across transfer tasks. A passed recall was awarded if the participant spontaneously recalled the target (Recall 1) or recalled the target when asked by the experimenter (Recall 2). A Cochran test, which evaluates differences among related proportions, was run on scores for recall across transfer tasks. The analysis revealed no significant differences among performance across the four transfer tasks, $Q = 1.20$, $p = .75$).

Explicit Memory for the Target Person

Immediate Recall/Recognition. At the end of each training session participants were asked to free recall, or recognize if they were unable to recall, the target person. Table 45 shows the results for each participant. During the first week of training, many participants were unable to free recall the target person. S5 consistently recalled the target over all three days. Only two additional successful free recall responses were observed in the first week of training, S1 in session 1 and S4 in session 3. In the second week of training, several

Table 45: Summary of Immediate Recall and Recognition Task

		Participants				
Measure		S1	S2	S3	S4	S5
Recall / Recog. Face / Recog. Name						
Week 1	Session 1	1/-/-	0/1/1	0/1/1	0/1/1	1/-/-
	Session 2	0/0/0	0/1/1	0/0/0	0/1/1	1/-/-
	Session 3	0/0/0	0/1/1	0/0/0	1/-/-	1/-/-
	Total	1/0/0	0/3/3	0/1/1	1/2/2	3/-/-
Week 2	Session 4	0/0/0	1/-/-	0/1/1	0/1/1	1/-/-
	Session 5	0/1/1	1/-/-	0/1/1	0/1/1	1/-/-
	Session 6	0/1/1	0/1/1	0/1/1	1/-/-	1/-/-
	Total	0/2/2	2/1/1	0/3/3	1/2/2	3/-/-
Week 3	Session 7	0/1/0	0/1/0	1/-/-	1/-/-	1/-/-
	Session 8	1/-/-	0/1/1	1/-/-	0/1/0	1/-/-
	Session 9	0/1/0	0/1/1	1/-/-	0/1/0	1/-/-
	Total	1/2/0	0/3/2	3/-/-	1/2/0	3/-/-

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task. * indicates missing data point.

participants were able to free recall the target person at the end of at least one session. S5 consistently recalled the target over all three days. S2 recalled the target on two of the days and S4 was successful on only one day. S1 and S3, however, were never able to free recall the target correctly. In the third week of training, four of the five participants were able to free recall the target person at the end of at least one session. S3 and S5 consistently recalled

the target over all three days. S1 and S4 recalled the target on one of the days and only S2 was never successful at free recall. With the exception of S5, most participants were never able to consistently recall the trained target person only moments after the completion of the session. This result is especially interesting in that the participants had been trained with the target on as many as 42 trials. This finding is consistent with the secondary memory impairment often found in older adults with probable AD.

When participants were unable to free recall the target, all nine pictures were presented again for the recognition task. Participants were quite successful at picking out the target from the other eight distractor pictures. S2 and S4 were able to recognize the target in every session. S3 had two sessions where he was unable to recognize the target and S1 had three sessions when she was unable to recognize the target. The fact that all participants were able to recognize the target, the majority of the time, suggests that they all had knowledge of the target person but may have been unable to access that knowledge during the free recall task. The re-presentation of the stimulus was enough to prompt successful recognition of the target. These findings are consistent with the results of the SPT data, which found participants did more poorly on free recall in comparison with cued recall (see Table 40).

Delayed Recall. Each participant's performance on the delayed recall task can be found in Table 46. As can be seen, only two participants successfully recalled the target, S4 in session 4 and S5 consistently across sessions. The other participants failed to successfully recall the target in the delayed recall task across all sessions. When unable to free recall the target, participants were asked to select the target's picture from the board and state her name. S2 and S4 consistently selected the target's picture when unsuccessful at recall. In addition, S2 and S4 correctly stated the target's name after selecting her picture in at least

Table 46: Summary of Delayed Recall Task

		Participants				
Measure		S1	S2	S3	S4	S5
Recall / Recog. Face / Recog. Name						
Week 1	Session 1	0/1/0	0/1/0	0/0/0	0/1/0	1/-/-
	Session 2	0/0/0	0/1/0	0/0/0	0/1/1	1/-/-
	Total	0/1/0	0/2/0	0/0/0	0/2/1	2/-/-
Week 2	Session 4	0/0/0	0/1/0	0/0/0	1/-/-	1/-/-
	Session 5	0/1/0	0/1/1	0/1/0	0/1/1	1/-/-
	Total	0/1/0	0/2/1	0/1/0	1/1/1	2/-/-
Week 3	Session 7	0/1/0	0/1/0	0/1/0	0/1/0	1/-/-
	Session 8	0/1/0	0/1/0	0/1/0	0/1/0	1/-/-
	Total	0/2/0	0/2/0	0/2/0	0/2/0	2/-/-

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task.

one session; S2 in session 5 and S4 in sessions 2 and 5. S1 selected the target's picture from the board in sessions 1, 5, 7 and 8. Similarly, S3 selected the target's picture from the board in sessions 5, 7, and 8. Neither S1 nor S3 could state the target persons name, despite correct picture recognition. These findings are similar to the results of the immediate recall task in that participants were unable to consistently remember the target when tested only with free recall. These results are comparable to those observed in delayed recall for the adjusted spaced retrieval group in Experiment 1 (see Table 18a, Experiment 1).

Final Delayed Recall/Recognition. Table 47 contains participants' scores on the final delayed recall task. Only two participants were able to free recall the target person, S4 (in

sessions 3 and 6) and S5 (in sessions 3, 6, 9). However, all other participants were able to recognize the target's picture when presented with the other eight distractor pictures. S2 correctly recognized the target in all three sessions, while S1 and S3 only recognized the target in sessions 6 and 9. For S2-S5, these data provide further evidence in support to the idea that participants retained the target information trained with spaced retrieval but were unable to free recall that information. These findings replicate those of the 48 hour delayed recall task. Participants, again, demonstrated their ability to recognize the target person but seemed unable to access that knowledge during free recall.

Table 47: Summary of Final Delayed Recall Task

		Participants				
Measure		S1	S2	S3	S4	S5
Recall / Recog. Face / Recog. Name						
Week 1	Session 3	0/0/0	0/1/0	0/0/0	1/-/-	1/-/-
Week 2	Session 6	0/1/0	0/1/0	0/1/0	1/-/-	1/-/-
Week 3	Session 9	0/1/0	0/1/0	0/1/0	0/1/0	1/-/-
	Total	0/2/0	0/3/0	0/2/0	2/1/0	3/-/-

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person, (-) indicates task was not administered due to success on the previous recall or recognition task.

Final Face Recognition Task

On the last day of the study (day 12), participants were presented with 18 photographs: 9 were the stimuli from the training sessions and 9 were new distractor items that they had never seen before. Participants were asked to identify the pictures they had seen before. Table 48 contains the results of performance on this task. Overall, all participants were able

to correctly identify more stimuli photographs (hits) than falsely identifying new items (false alarms). Importantly, all five participants were able to select the target picture as a photograph they had seen before. These findings provide evidence that mere exposure to the photographs during spaced retrieval training is not sufficient for maintaining recall and recognition of the items. Spaced retrieval training on the item may be necessary for success in recalling or recognizing the item.

Table 48: Summary of Final Face Recognition Task

	Participants					
	S1	S2	S3	S4	S5	Mean
Old Items						
Hits	3	1	4	3	3	2.80
Misses	6	8	5	6	6	7.78
New Items						
False alarms	0	0	1	1	0	0.50
Correct responses	9	9	8	8	9	10.75

Note. Entries are based on a total of 9 facial pictures used in SR training ("old items") and 9 distracter faces ("new items").

Quality of Life

Participant Reports. The dementia quality of life measure (DQoL) was administered to all participants prior to (day 2) and after training on the name-face association (day 12). Table 49 contains participant results of pre and post training performance on this measure. On average, participants increased their ratings somewhat on all of the quality of life scales except for self-esteem and the absence of negative affect scale, where they decreased slightly (see Table 49). Independent samples *t* tests were run to determine differences between participant's rankings at pretest and posttest on the six scales that comprise the DQoL. The participants had higher rankings on the positive affect scale at posttest (M = 4.17) in comparison to pretest (M = 3.59), t (4) = 2.34, $p < 0.05$. No additional significant effects resulted from the analysis. Again, these trends are preliminary, but taken together with the results of Experiment 1, they offer some evidence that the success obtained via spaced retrieval training appears to be transferring, even if slightly, to the patients' feeling better about their quality of life.

Caregiver Reports. We also administered the DQoL to participant caregivers prior to and after the participants training program for a ranking of what they believed to be the patient's current quality life. Table 50 contains caregiver results of the pre training performance on this measure[7]. Evaluation of Pre and Post DQoL scores given by caregivers was not available due to caregivers not completing the posttest DQoL. Only one caregiver

[7] S1's caregiver did not return the pretest DQoL.

Table 49: Pre and Post Test Performance on the DQoL by Participants

	Scales											
	Self-Esteem		Positive Affect / Humor		Absence of Negative Affect		Feelings of Belonging		Sense of Aesthetics		Overall Quality of Life	
Participants	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
S1	4.25	4.00	3.33	4.17	3.73	4.09	3.33	3.67	2.80	3.00	4.00	4.00
S2	4.25	3.75	3.33	4.50	3.36	3.36	2.67	3.67	3.80	4.60	4.00	5.00
S3	3.00	2.50	2.33	2.67	4.00	3.45	2.67	2.00	3.20	3.20	4.00	4.00
S4	4.50	4.75	4.33	4.50	4.00	3.91	4.00	4.33	5.00	4.20	3.00	4.00
S5	4.00	4.50	4.67	5.00	3.64	3.55	3.00	4.33	4.80	5.00	4.00	4.00
Mean	**4.00**	**3.90**	**3.60**	**4.17**	**3.75**	**3.67**	**3.13**	**3.60**	**3.92**	**4.00**	**3.80**	**4.20**

Note. Scores range from 1-5 with higher scores indicating a higher quality of life.

(S2) completed the posttest DQoL. S2's caregiver reported improvement on two scales at posttest, sense of aesthetics (3.80 pretest, 4.20 posttest) and overall quality of life (3.00 pretest, 4.00 posttest). She reported slightly lower scores on the other four scales contained in the DQoL. The lack of caregiver follow up is unfortunate but is also understandable due to the immense stress and time constraints faced by most caregivers of persons with AD.

Comparison of Participant and Caregiver Responses on the DQoL. To assess differences between participants and caregivers ratings of participant quality of life we compared participant and caregiver reports on the pre test DQoL. An Independent samples *t* test revealed caregivers rated participant's quality of life lower than participants did at pretest on two of the six DQoL scales. Lower rating were reported by caregivers ($M = 2.69$) in comparison to participants ($M = 4.00$) on the self-esteem scale, $t(7) = 4.16$, $p < .01$ and on overall quality of life (caregivers $M = 3.00$, participants $M = 3.80$), $t(21) < .05$. There appear to be differences in how caregivers and participants interpret the participant's quality of life, likely based on caregiver appraisals reflecting the deterioration as a result of Alzheimer's.

Quality of Participation in Study

On the last day of the program participants were asked about how they liked participating the training program. Table 51 contains participant's actual responses to the six questions as well as an overall quality of participation in the study score. Inspection of the table reveals most all participants enjoyed participating in the study. The exception is S1 who reported enjoying the actual task of selecting the target picture and learning the target person's name 'very little'. This response to the task is not surprising considering S1 did very poorly on the actual training task (see Table 43).

Table 50: Pre Test Performance on the DQoL by Caregivers

	Scales					
	Self-Esteem	Positive Affect / Humor	Absence of Negative Affect	Feelings of Belonging	Sense of Aesthetics	Overall Quality of Life
S1	-	-	-	-	-	-
S2	2.50	4.33	3.73	4.00	3.80	3.00
S3	2.50	2.67	3.82	3.00	2.20	3.00
S4	2.75	3.00	2.27	3.67	2.60	3.00
S5	3.00	4.17	3.27	3.67	2.60	3.00
Mean	**2.69 (0.24)**	**3.54 (0.83)**	**3.27 (0.71)**	**3.59 (0.42)**	**2.80 (0.69)**	**3.00 (0.00)**

Note. Scores range from 1-5 with higher scores indicating a higher quality of life.

Experiment 3 Discussion

Experiment 3 provides evidence that the spaced retrieval paradigm can be adapted for use to promote learning of a familiar name-face association. This study offers preliminary evidence that the learning of a familiar name-face association takes place in fewer training sessions, as evidenced by greater success in the live person transfer task in week 1 when compared to previous studies where success on the transfer task was not observed until weeks 2 and 3 (see Table 15a, Experiment 1). There is also initial evidence that the familiar name-face association learned via spaced retrieval leads to participants applying the association outside of the training. Two of the four participants (S2, S5) who learned via spaced retrieval training spontaneously called the target by name outside of the testing

Table 51: Score for Quality of Participation in the Study

	Participants				
	S1	S2	S3	S4	S5
Getting pulled out of normal activities	2	5	3	4	5
Learning the name of the person in the picture	1	4	3	4	5
Selecting the correct picture	1	5	4	4	5
Talking with me	4	5	3	4	4
Telling me about yourself	4	3	3	5	5
Helping me with my school work	4	4	4	4	5
Overall quality of participation	2.67	4.33	3.33	4.17	4.83

Note. Scores range from 1 – 5 with higher scores indicating a higher enjoyment for participation in the training.

sessions, according to caregiver self report (see Table 42). In addition, there is evidence that earning and applying the name-face association may improve patient perceptions of quality of life and quality of participation in the study. Interestingly, the two subjects who called the target by name outside of testing (S2, S5) scored highest on quality of participation in the study (see Table 51) and scored higher on the majority of scales in the DQoL after training (see Table 49). These findings are exciting in that the intervention may produce memory gains that extend to applying the knowledge outside of a training session and impact participant's quality of life.

GENERAL DISCUSSION

The present research yielded four principle findings of interest with respect to the study of memory interventions for cognitively impaired older adults. First, the results of Experiment 1 indicated that adjusted spaced retrieval provided a more consistent performance pattern in comparison to a fixed interval retrieval schedule. Second, Experiment 2 provided evidence of long-term maintenance of the spaced retrieval training intervention at a 6-month retest. In addition, evidence of the efficacy of booster sessions was also observed, especially early on at 6-month retest. Third, the adaptability of the SR technique was demonstrated for use with a familiar name-face association. Fourth, these findings provide initial evidence about the non-cognitive benefits of spaced retrieval training, specifically, positive effects on quality of life, associated with the spaced retrieval intervention. These findings and their implications for future work in a SR paradigm are discussed more fully in turn.

Adjusted Spaced Retrieval versus Fixed Interval Retrieval Training

In Experiment 1 we conducted a spaced retrieval experiment that included a critical control group, who receive an equal number of training trials on a fixed interval retrieval schedule. Inclusion of the control group was necessary to draw firm conclusions regarding the contribution of the spacing effect to new learning in this intervention. The results indicate that adjusted spaced retrieval training provided a more consistent performance profile in comparison to the fixed interval retrieval training program on recall of the name-face association. This consistency in performance was observed in several tasks throughout the training program including training trial performance, free recall performance and

transfer of the name-face association to the live target (transfer task). Regarding training performance, all six of the adjusted spaced retrieval participants increased their proportion correct scores from week 1 to week 3 of training (see Table 13). In comparison, the fixed interval retrieval group's outcomes were much more mixed, with two participants (S9, S12) increasing in their proportion correct from week 1 to week 3, while the remaining participants (S7, S8, S10, S11) decreased in their proportion correct from week 1 to week 3. There is clear evidence of the adjusted SR group outperforming the fixed interval retrieval group over the three weeks of training. When evaluating the training task performance in week 1 the fixed interval retrieval group outperformed the adjusted SR group (see Table 13). However, as previously noted this trend did not continue and by the end of three weeks of training the adjusted spaced retrieval group was performing better as reflected in numerically higher proportion of correct trials.

Free Recall Performance. Superior performance by the adjusted spaced retrieval group was also evident in free recall of the target on immediate recall, delayed recall (48 hour) and final delayed recall (72 hour). In the first week of training, all adjusted SR participants, with the exception of S5, free recalled the target at immediate recall. In comparison, only half of the fixed interval retrieval group (S9, S10, S12) were able to free recall the target just following the training trials. In week 2, the adjusted SR group continued to outperform the fixed interval retrieval group with three participants (S1, S4, S5) free recalling the target at each session and two participants (S2, S3) recalling the target at sessions 5 and 6. The fixed interval retrieval group had only two participants that were able to free recall the target during week 2 (S3, at each session and S2 at sessions 4 and 6). By week 3 all of the adjusted SR participants free recalled the target during at least two sessions (S1, S3, S4, S5

all sessions; S2, S6, two out of three sessions). In contrast, after three weeks of training, only half of the fixed interval retrieval participants free recalled the target (S9, S12 all sessions, S10 two out of three sessions). These results are striking in that only two fixed interval retrieval participants were able to consistently free recall the target immediately after training, despite nine sessions of training with the target.

The delayed recall task (48 hour) and the final delayed recall task (72 hour) offer further evidence of the superiority of the adjusted spaced retrieval group on long-term retention of the name-face association. After three weeks of training, four of the six adjusted SR participants (S1, S3, S4, S5) free recalled the target after a 48 hour delay. In comparison, only two fixed interval retrieval participants are able to do so (S9, S12). After three weeks of training, the final delayed recall (72 hour) task results provide a more striking contrast between the two groups. All but one member (S2) of the adjusted spaced retrieval group free recalled the target whereas only one of the fixed interval retrieval participants (S9) was able to do so. In addition, the adjusted spaced retrieval group displayed success at the final delayed recall task throughout all weeks of training (S4, S5 in sessions 3, 6 and 9; S1 in sessions 6 and 9). However, S9, the sole fixed interval retrieval participant who obtained success, only did so in session 12, after three weeks of training. The finding of better free recall after training is consistent with the results of Hochhalter et al., (2004) who found adjusted spaced retrieval training to be superior to a uniform training schedule for free recall of a medication (pill) name at 24 hour delay.

Transfer of Association to a Live Person. The results of the live person transfer task offer some of the most compelling evidence as to the superiority of the adjusted spaced retrieval program in comparison to the fixed interval retrieval program. By week 3, half of

the adjusted spaced retrieval participants (S2, S4, S5) were able to call the target by name when asked by the experimenter (see Recall 2). Two additional participants (S1, S6) were able to call the target by name (Recognition Name) after correctly selecting her picture from the board (Recognition Face) and the last participant (S3) was able to call the target by name (Recognition Name) after being handed the target picture. All of the adjusted SR participants were able to call the live target by name in week 3 at some point during the transfer task: S1, S4, S5 when asked by the experimenter (Recall 2), S1 and S6 called her by name (Recognition Name) after selecting her picture from the board (Recognition Face) and S2 after being handed the photograph (Recognition Name). In contrast, by week 3 only one fixed interval retrieval participant (S9) was able to call the live person target by name when asked by the experimenter (Recall 2). In addition, only two other fixed interval retrieval participants (S10, S12) were able to call her by name (Recognition Name) after selecting her picture from the board (Recognition Face). The remaining three fixed interval retrieval participants (S7, S8, S11), were only able to correctly select the target's picture from the board (Recognition Face) but could not call her by name (Recognition Name). In week 3 only half of the fixed interval retrieval participants called the live target by name; S9 via free recall and S10 and S12 after selecting her picture from the board.

At the 72-hour delay transfer task, one adjusted spaced retrieval participant (S4) spontaneously called the target by name (Recall 1), while two additional participants (S5, S6) called the live target by name when asked by the experimenter (Recall 2). In comparison, only one fixed interval retrieval participant (S9) was able to call the target by name when asked by the experimenter (Recall 2) and one additional participant (S10) was

able to call the target by name after selecting her picture from the board (Recognition Name and Face).

The results of the training performance, free recall performance and the live person transfer indicate that adjusted spaced retrieval is superior to a fixed interval retrieval training program for learning a name-face association and transfer of that association to an actual person. These findings appear to indicate that the spacing effect and not mere repetition of trials alone is contributing to the gains observed in the adjusted spaced retrieval group.

Based on the results of the week 1 training performance, one direction for future research would be to evaluate additional training schedules against the adjusted spaced retrieval intervention. Future research should include evaluation of additional training schedules such as a purely fixed (10 s across all sessions for three weeks) to determine more clearly if spaced retrieval is superior to other potential schedules. The results of the current study conflict with recent findings by Hochhalter et al., (2005) who found spaced retrieval to be no more effective than other training schedules in promoting recall of pill names. While observed performance between the groups was not statistically significantly, visual analysis of the data indicates adjusted spaced retrieval the stronger of the two schedules.

Long-term Maintenance and Effectiveness of Booster Sessions

The second finding of interest that emerged from the present research is evidence of long-term retention of the SR intervention at a 6-month retest and the efficacy of supplemental training sessions or 'booster sessions' to enhance the long-term maintenance of the intervention. Experiment 2 examined the effectiveness of adding booster sessions during the interval between original test and retest at six months. We expected to find that participants who received the 'booster' sessions would perform better than the participants

who received no additional training at retest. Our results indicated that the booster sessions appeared to be most beneficial at the onset of 6-month retest. Within three sessions, however, the control participants who did not receive booster sessions were performing comparably to the booster group, as discussed more fully later on.

Long-term Effectiveness of Spaced Retrieval. First, these data provide evidence of the long-term effectiveness of spaced retrieval for a time interval of 6-months. Cherry and Simmons-D'Gerolamo (2004) found benefits of prior spaced retrieval training on retest at intervals as long as eleven months, but not longer than 18 months. In the current study we found clear evidence of a benefit of prior task experience on spaced retrieval performance in the within subjects comparisons (i.e., retested participants compared to their original performance). All subjects decreased in the number of failed trials (FT) at retest in comparison to original test, except for S4 who had 1 more failed trial in session 2 at retest and no failed trials in session 3 at original training or Retest (see Table 30a and 30b). In general, the within-subjects comparisons revealed all participants (with the exception of S5-R session 1 and S4-R sessions 2 and 3) increased in longest duration (LD) at time of retest in comparison to original testing (see Table 30a and 30b). These findings are exciting in that despite a progressive cognitive condition such as Alzheimer's disease, participants are performing better at retest than at original training.

There is also evidence from the live person transfer task data to indicate benefits of prior SR training. The first transfer task was held prior to beginning the retest spaced retrieval training trials. All participants recognized the target picture on Day 1 even though they did not know her name, except for S4 who failed all tasks on Day 1. This is remarkable considering participants in the booster group had not seen the target in six weeks and

participants in the no booster group had not seen the target in six months. The findings from the first retest transfer task combined with the training performance results suggest that the benefits of prior spaced retrieval training are evident at a 6-month retest interval.

Efficacy of Booster Sessions. Experiment 2 provided evidence that additional training or booster sessions within the retest period can lead to better training effects, at least initially. The booster group performed much better in comparison to their no booster counterparts in session 1 on proportion correct and longest duration (see Table 31). The booster group also outperformed the no booster group on Immediate Recall (see Table 35a and 35b). These findings are impressive considering that two participants in the booster group (S1, S3) have MMSE scores of 16 in comparison to two of their no booster counterparts (S4, S5) that have MMSE scores of 23 (see Table 24). By session 3, the no booster session group was outperforming their booster session counterparts. It appears that booster sessions aided in improving memory gains and long-term maintenance of the trained information initially but that performance gains made at initial SR training were brought to a comparable level after only a few days of re-training. For the no booster session group, it appears retest sessions 1 and 2 are acting as booster sessions for retest session 3. From an applied perspective this is exciting in that it may only be necessary to retrain the information or offer booster sessions to participants when the trained knowledge is desired.

The live person transfer task provided mixed evidence of the efficacy of booster sessions. All of the booster session participants were able to call the live target by name at least once during the retest live person transfer tasks (see Table 34). In comparison, two of the three no booster group participants were able to call the live target by name during the retest transfer tasks. These findings indicate slightly superior performance by the booster

session group. However, the results also demonstrate that with or without booster sessions, previous spaced retrieval training gains on a name-face association and the transfer of that association to a live target may be accessible at a 6-month retest. The finding that all booster session participants called the live target by name despite their lesser cognitive status indicates booster sessions may be useful in assisting lower MMSE participants to obtain memory performance levels observed in higher MMSE participants.

One interesting idea this study provides is that booster sessions may be particularly helpful for those that are more cognitively impaired. Even though the booster group had lower MMSE scores (M = 17.3) compared to the no booster group (M MMSE = 21.3), the booster group still outperformed the no booster group at retest, initially. This was a serendipitous and exciting finding in that even with a more impaired population, performance gains can be demonstrated through the use of additional training. Future research should include investigation of performance at retest by participants of a wider range of cognitive levels that have received booster sessions to provide further insight into the dynamic relationship between booster sessions and level of cognitive impairment.

Another area that must be further investigated is the potential variations created by comparing participants that have had additional training sessions versus those who have not had additional training sessions. One direction for future research would be to provide the same amount of training (booster sessions) to both groups and vary the times these sessions are implemented. For example, providing one group with booster sessions at the end of initial training and one group with booster sessions spaced out during the delay between original training and retest. This would allow for conclusions to be drawn about the gains made through the booster session schedule versus a lengthened initial training program.

Adaptation of SR Paradigm for Familiar Name-Face Association

The third major finding that emerged from these studies was that the SR technique can be adapted for use with a familiar name-face association. Hawley and Cherry (2004) found that spaced retrieval could be successful in training an unfamiliar name-face association. In addition, the intervention demonstrated successful transfer to a live but unfamiliar person from a picture. In Experiment 3, we used the same methods and procedure as in Hawley and Cherry (2004), but the target was a person familiar to the participant. The positive effect of spaced retrieval training on recall of the correct name-face association was evident for the majority of participants (see Table 43). The proportion correct (PC) scores increased from session 1 to session 9 for all participants (except for S1 who never mastered the training task). In addition, the longest duration increased for most participants from session 1 to session 9, except for S2 who produced a consistent longest duration (LD) in session 1 and session 9. That is, most participants were able to retain the correct name-face association for longer retention intervals across training sessions.

Participant's performance on the live person transfer task also indicated success in learning the familiar name-face association (see Table 44). Overall, most participants improved on the task from week 1 to week 3 (with the exception of S1), although S4's performance decreased over training sessions. Of those participants who had success during SR training (S2, S3, S4, S5), all were able to free recall the target at some point during the transfer tasks. In week 1, two participants (S4, S5) recalled the target by name when asked by the experimenter (Recall 2). In week 2, S3 spontaneously recalled the target when they approached the testing table (Recall 1) and S2 and S5 recalled the target when asked by the experimenter (Recall 2). In week 3, two participants (S2, S5) recalled the target by name; S2

when asked by the experimenter (Recall 2) and S5 when the target approached the testing table (Recall 1). At the 72 hour delay three participants (S2, S3, S6) called the target by name when asked by the experimenter (Recall 2).

The findings from the transfer task are exciting as they provide evidence of the name-face training transferring to a live person after only one week of training. Two participants (S4, S5) were able to call the live person target by name in week 1. In Hawley and Cherry (2004) where non-familiar faces served as targets, no participants free recalled the target in week 1. Experiment 1 also used a non-familiar face as the target and no participants free recalled the target in week 1 (see Experiment 1, Table 15a). By week 2, two additional participants free recalled the live familiar target whereas work with a non familiar target in Experiment 1 found only one person able to free recall the target in week 2 (see Table 15a). The findings from the live person transfer task indicate that a three week training program may not be necessary to achieve success on the live person transfer when training a participant on a familiar face. Future research should include comparisons of additional training schedules such as fewer training sessions, to determine if memory gains on the familiar name-face association are available without a total of three weeks of training.

Potential Quality of Life Benefits from Spaced Retrieval Training

Finally, findings from these studies provide initial evidence of non-cognitive benefits associated with the spaced retrieval intervention. In all experiments, quality of life was measured by the Dementia Quality of Life Measure (DQoL) instrument (Brod et al., 1999). Results suggested that increased quality of life scores were linked to successful spaced retrieval performance. The results of the participant pre and post test DQoL in Experiment 1 found higher scores in four of the five scales for the adjusted spaced retrieval group,

whereas the fixed interval retrieval group had lower scores on four of the five scales after training (see Table 21). Perhaps actual memory successes contributed to an increase in the quality of life scores, which would explain the pattern observed between the two groups. The fact that both groups were not improving may indicate that social contact alone is not contributing to gains in quality of life observed in the spaced retrieval group.

The results of Experiment 2 provide further evidence of the relationship between increased quality of life, as measured by the DQoL, and the spaced retrieval intervention. Performance on the DQoL at Retest revealed the no booster group scored higher on all scales in comparison to their booster group counterparts, except on the feelings of belonging scale. The finding that the booster group was not outperforming the no booster group lends additional support to the idea that something beyond social contact is improving these participants' feelings about their quality of life. If social contact alone were improving ratings of quality of life, one would anticipate participants in the booster session group, having received twelve additional training sessions with the experimenter, would perform higher on the quality of life measures. However, the no booster group scored higher on several scales in the DQoL. In addition, the no booster group performed better on the actual spaced retrieval training retest in session 3. These findings may indicate that success on the name-face task could improve the Alzheimer's participant's self-rated quality of life. Further research is warranted, as gains in quality of life were not statistically significant.

Experiment 3 also provided evidence that successful SR training on a familiar name-face association may lead participants to report higher quality of life. In particular, two of the four participants (S2, S5) who had success in training called the target by name when encountered outside testing. These two participants scored particularly high at posttest on

the feelings of belonging scale. Both S2 and S5 increased their feelings of belonging score at least a full point higher at posttest in comparison to the pretest score on this scale. This finding may indicate that calling a familiar person by name raises feelings of quality of life in cognitively impaired older adults.

The results of these initial studies of the spaced retrieval intervention and the effects on quality of life are promising. These findings add to the small but growing literature showing that interventions for persons with dementia can produce improvement on psychosocial measures such as affective scores (Kesslack, Nackoul, & Sandman, 1997) and quality of life in nursing homes (Simard, 2000). Further research is warranted to replicate the present findings, which suggest that self-rated quality of life are linked to success on the spaced retrieval task.

In addition, exploration of the impact of the intervention on the caregiver's quality of life should also be explored. As noted previously, dementia caregivers are under a lot of stress and suffer high rates of depression (Ory et al., 1999). One could speculate that having a family member or resident call you by your name may increase positive feelings for the family member or patient and improve interactions, thereby improving the caregiver's quality of life.

Implications for Caregivers

The findings from these studies are exciting for both persons with AD and their caregivers. Experiment 3, in particular provides evidence that persons with AD can be trained or retrained to call important persons in their lives by name. Having a loved one call you by name after years of not being able to do so can have important significance for AD caregivers. For example, one participant's family member became very emotional when her

mother called her by name and stated her mother had not done this for the past two years. She was overwhelmingly grateful and stated it meant the world to her. Why the memory gains alone from the spaced retrieval intervention are impressive, the clinical impact on family members cannot be overlooked. Future research with the SR intervention should incorporate other tasks that may be particularly meaningful to persons with AD and their caregivers such as training a particular memory or story to a photograph. For example, train the participant to discuss a particular memory from a trip to the beach when looking at the photograph from that trip.

In closing, the results of the present studies are encouraging. The implications for both caregivers and the AD participants themselves are noteworthy. From an applied perspective, it appears older adults with probable AD could be taught to recall important persons in their life by name, thus increasing a sense of mastery and increased overall self-esteem. Caregivers and family members may experience less frustration with older adults with probable AD, if a connection could be maintained through the use of the significant person's name. Ideally, the technique could be taught to both caregivers and family members for application in the home environment. The results here warrant exploration of the efficacy of this technique with other dementia populations such as persons suffering with multi-infarct dementia, HIV induced dementia or persons suffering cognitive impairment from other trauma to the brain.

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APPENDIX A

QUALITY OF PARTICIPATION IN THE STUDY QUESTIONNAIRE

Quality of Participation in the Study

Participant will be handed a large print card with the following responses:

Not at all enjoying something
Enjoying it a little
Enjoying it some
Enjoying it quite a bit
Enjoying something a lot

Participants will be asked to point to their response after the question is read aloud.

During our time together, how much have you enjoyed:

_____ Getting pulled out of your normal activities?

_____ Learning the name of the person in the picture?

_____ Selecting the correct picture?

_____ Talking with me?

_____ Telling me about yourself?

_____ Helping me with my school work?

APPENDIX B

PARTICIPANT AND TARGET PERSON INTERACTION FORM

Participant and Target Person Interaction

Date: _____

Time: _____

Length of the interaction: (1 hour, etc.): _____

Nature of the interaction (e.g. Lunch): _____

_____

Did the participant call the target by name? Circle one: Yes No

If yes, approximate number of times: _____

Did the person make any reference to the training program? (For example, I saw a picture of you the other day or we were talking about you yesterday) Circle one: Yes No

If yes, please give as much detail as possible: _____

_____

_____

_____

_____

_____

APPENDIX C

DATA FROM HAWLEY & CHERRY (2004) FIRST DAY OF TRAINING

Trials until 1st Successful Recall on First Day of Training

Subject	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7
1	P	P	F	P	P/F	P	F
2	P	F	F	P	P	P	F
3	P	F	F	F	P/F	P	F
4	F	F/P	F	F/P	F/P	F	P
5	F	F	P/F	P/F	F	P	P

Note. Trials began with 5-second interval. P = passed, F = failed, F/P denotes participant handed the experimenter the correct photograph, but incorrectly recalled the correct name and P/F indicates the participant handed the experimenter the incorrect photograph, but recalled the correct name.

VITA

Karri S. Hawley recently concluded her doctoral program of study in developmental psychology at Louisiana State University. Mrs. Hawley's areas of interest include cognitive aging and more specifically Alzheimer's disease. Karri obtained a Bachelor of Science degree in psychology from Georgia Southern University in 1993. She went on to complete a Master of Education in counseling at The University of North Florida in 1996. Karri received her master of arts in psychology from Louisiana State University in May 2002 and will be awarded her Doctor of Philosophy in psychology in August 2005.